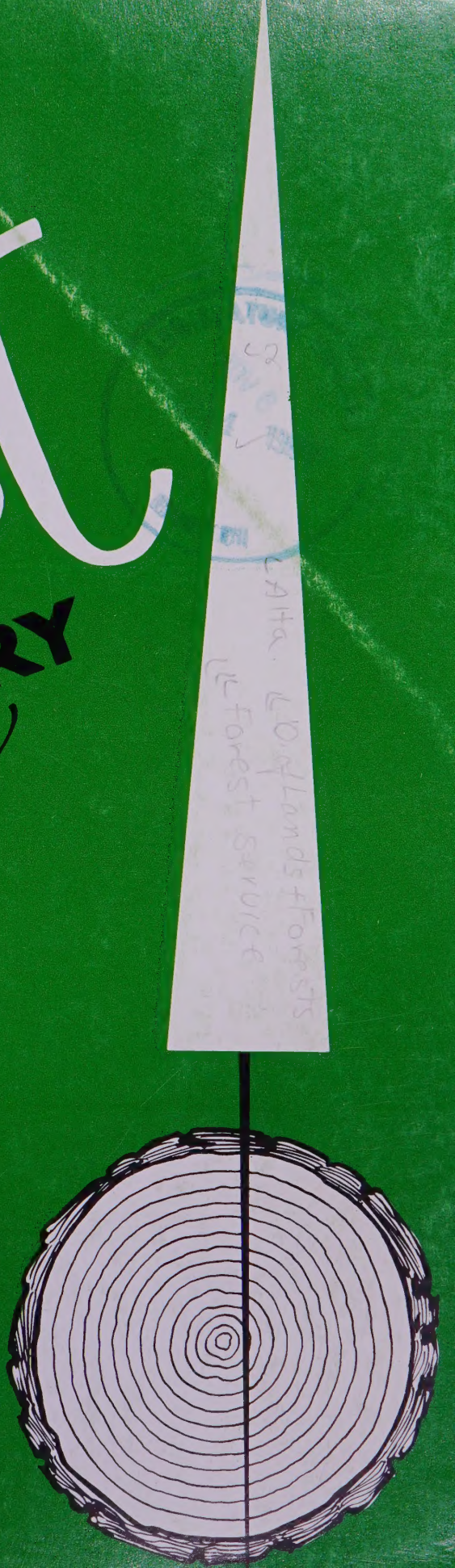
ALBERTA forest INVENTORY



Alberta Forest Inventory

ALBERTA

DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

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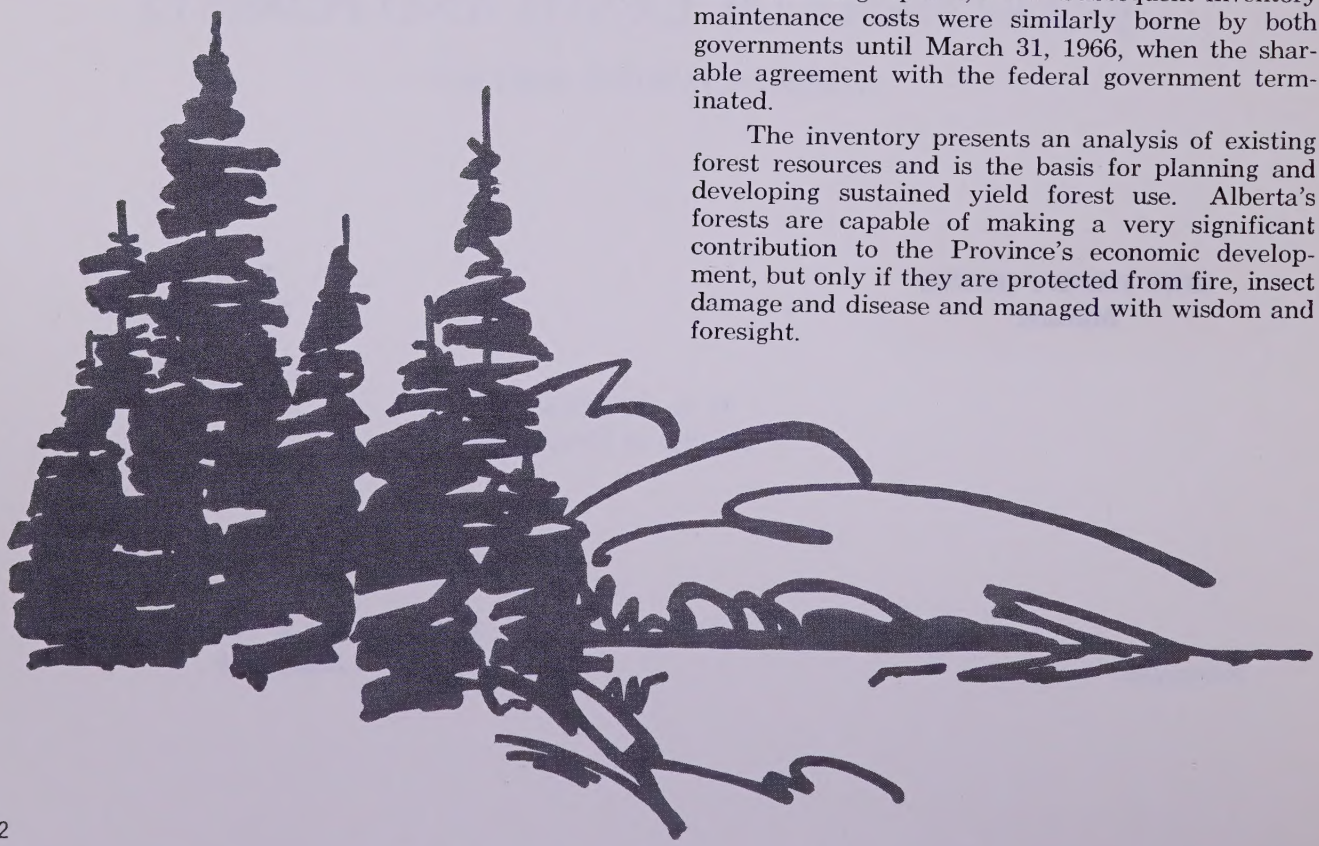
PREFACE

An inventory has been made of the forest resources of Alberta. This inventory was carried out in two stages. First, an assessment of the Province's timber supply was completed in 1956 and this study covered most of the forested area. Later an additional survey was undertaken to determine the volume of timber in the Rocky Mountains Forest Reserve and adjacent area and this project was finished in 1962. In all, 150,000 square miles were covered in the two inventories. This publication summarizes the data obtained from the complete inventory. Timber on Metis settlement area is administered by the inhabitants and not by the crown, but summary data that follow include forest statistics for these colonies. However, tabled details are provided separately. National Parks have been excluded from the inventory.

The forest regions of Alberta are divided into eleven Forests for administrative facility. Much of the following information is presented under headings that define these divisions. In addition, the province has been divided into management unit areas and inventory data can be supplied, if required, in management unit terms.

The government of Canada shared with the government of Alberta in the costs of the forest inventory. An agreement made under The Canada Forests Act provided for cost sharing of inventory work following April 1, 1951. Subsequent inventory maintenance costs were similarly borne by both governments until March 31, 1966, when the sharable agreement with the federal government terminated.

The inventory presents an analysis of existing forest resources and is the basis for planning and developing sustained yield forest use. Alberta's forests are capable of making a very significant contribution to the Province's economic development, but only if they are protected from fire, insect damage and disease and managed with wisdom and foresight.



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SCOPE OF FOREST INVENTORY

Earlier in this century Alberta forests were regarded as a hindrance to settlement rather than a useful resource. More recently the value of forest producing regions and their contributions to Provincial economic stability gained recognition; it was realized that they could, under thorough protection and management, provide a substantial and renewable yield of forest products. Lumber consumption during the latter part of World War II and subsequent years increased so rapidly that the yearly drain from Alberta forests appeared to exceed the annual growth and a comprehensive picture of forest resources became an urgent requirement. While forestry staff and timber operators could make reasonable estimates of the volume of merchantable timber available, such general information was of little practical value to adequate forest management planning. Thus was the need for a forest inventory established; one which would determine the relationship between timber growth and drain and provide a plan for the orderly utilization of known forest resources. Today, as a consequence of a complete forest inventory, a forest management program of considerable scope, aimed at sustained yield and continuous production, has been developed.

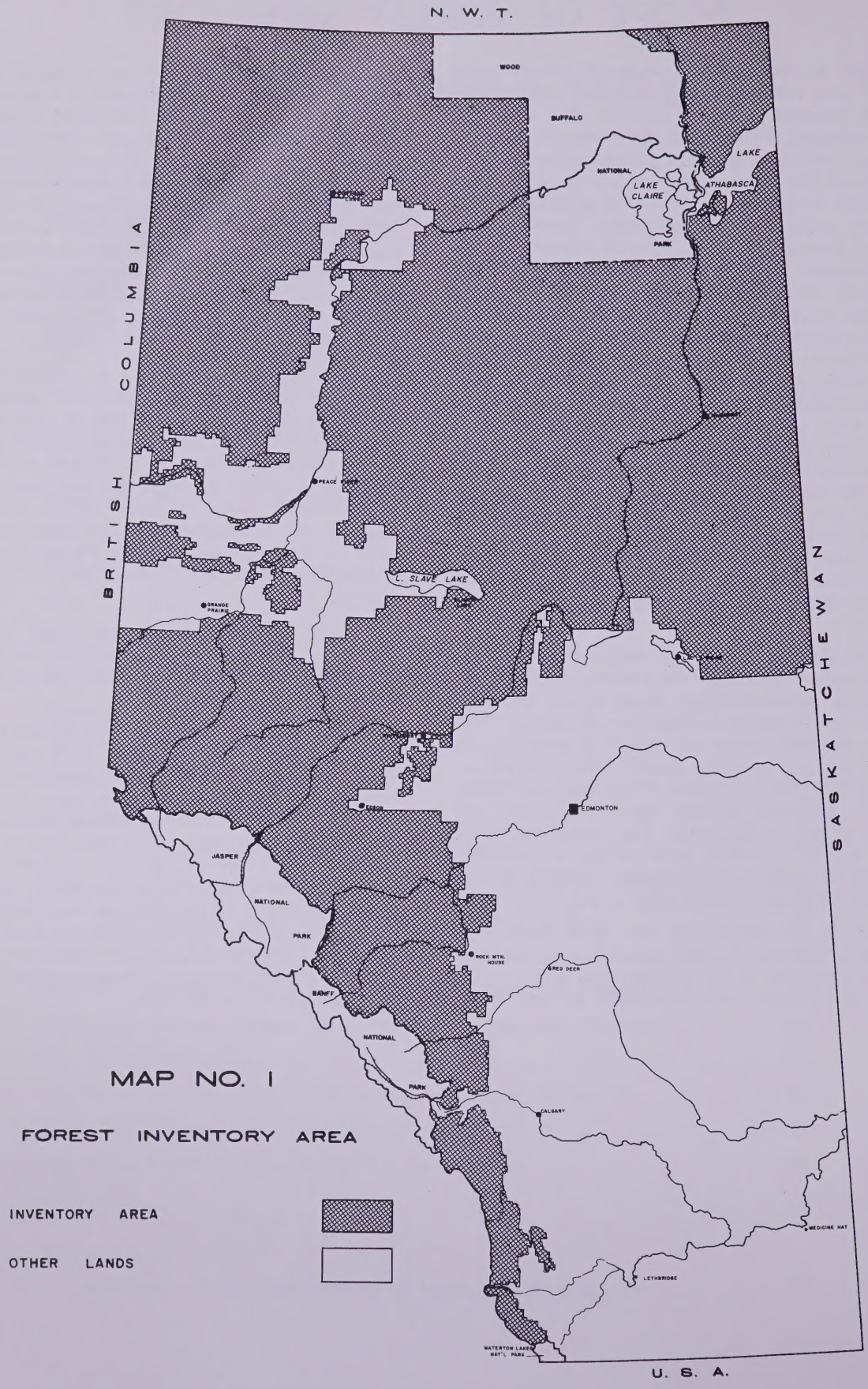
Aerial photography is an initial phase of any forest inventory program. In addition to providing illustrations for identifying forest cover, the photography can provide a basis for mapping. The need for accurate maps of unsettled parts of the Province became pressing during Alberta's oil exploration progress in the late 1940's and the 1950's. When the Province realized that an extensive program of aerial photography and mapping would provide highly classified information to both forestry and oil industries it quickly decided to proceed. Aerial photography began in the fall of 1949.

Much of the early work was done under contract and by March 31, 1953, the following material had been supplied; aerial photographs at a scale of 3,333 feet to one inch (1:40,000) of the entire Provincial area of 255,000 square miles; aerial photography for forestry purposes at a scale of 1,320 feet to one inch (1:15,840) covering approximately 94,000 square miles, (excluded were, that part of the Province for which the Federal Government was supplying maps, National Parks, Indian Reserves and the Rocky Mountains Forest Reserve), planimetric maps at a scale of 3,333 feet to one inch and one mile to one inch (1:63,360) covering 186,000 square miles: a forestry inventory, including maps at scales of 1:40,000 and 1:63,360 of approximately 81,400 square miles covering the forested areas south of the 57th parallel of latitude.

By 1953 it was decided to extend the forest inventory to include the area of approximately 61,000 square miles contained in the portion of Alberta lying north of the 57th parallel, excluding Wood Buffalo Park. An additional 28,000 square miles of 1:15,840 photography was contracted out to cover the more valuable forest areas in this region. All other phases of the inventory for this area were completed by the Forest Surveys and Planning Branch of the Department of Lands and Forests.

Early in 1956 forest type maps and forest inventory statistics were available for all of the Provincial forest land in Alberta except the Rocky Mountains Forest Reserve.

The forest inventory for the Rocky Mountains Forests Reserve and adjacent area was begun in 1958. The bulk of the aerial photography for the region, an area of 11,000 square miles, was taken in 1957 and 1958 with the remaining photography being done in 1960. The aerial photographs were at a scale of 1,320 feet to the inch (1:15,840) as were the planimetric and forest inventory maps. The forest inventory for the Reserve and adjacent area was carried out by the Forest Surveys and Planning Branch. In 1962 the project was completed and forest inventory maps and timber volumes estimates were available for the area.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WOOD
BUFFALO
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BRITISH COLUMBIA
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RED DEER
BANFF
NATIONAL
PARK
CALGARY
MEDICINE HAT
LETHBRIDGE
WATERTON LAKES NAT'L PARK
U. S. A.
MAP NO. 1
FOREST INVENTORY AREA
INVENTORY AREA
OTHER LANDS

FOREST INVENTORY PROCEDURE

A plan of codes and specifications was drafted prior to proceeding with inventory to obtain the required uniformity of classification. Following are some of the major requirements:

the extent to which forest types should be detailed in inventory;
the codes that would be used to designate differences in height and density in forest cover;

the selection of mapping symbols that would define relative productive capacity of unit areas;

the selection of trade accepted symbols for identifying tree species on maps;
the extent of ground crew research which would be required to verify aerial photo interpretation.

The initial and probably the most important phase of the inventory was the identification of forest types by the study of aerial photographs. This work was done by examination of the 1:15,840 photographs with pocket stereoscopes of two power magnification. Staff members engaged in this work were also employed in the field in the summer months. This enabled them to become familiar with field conditions and increased their ability to correctly interpret the forest conditions on the photographs.

All forest lands were classified on the photographs according to the nature of the ground cover. The presently productive areas were assigned type symbols designating the height, density and species present. Old burn, recent burn and cut-over areas received appropriate symbols and were grouped into the broad class of potentially productive forest land. Other areas such as muskegs, brushlands, alpine, barren, etc., of no commercial forest value, were typed as such and grouped as non-productive forest land.

Early photography was exposed on panchromatic film that was suitable for mapping but not sensitive enough to shades of green to provide differentiation between separate tree species. After 1953 modified infra-red photography was used exclusively during summer months and provided excellent tonal contrasts, particularly between deciduous and coniferous species.

In the northern Alberta inventory, planimetric maps at a scale of 1:40,000 were used as base maps on which to superimpose the forestry detail. Each map covered 30 minutes of longitude by 15 minutes of latitude. In the Reserve, base maps at a scale of 1:15,840 were employed with each base map covering a township.

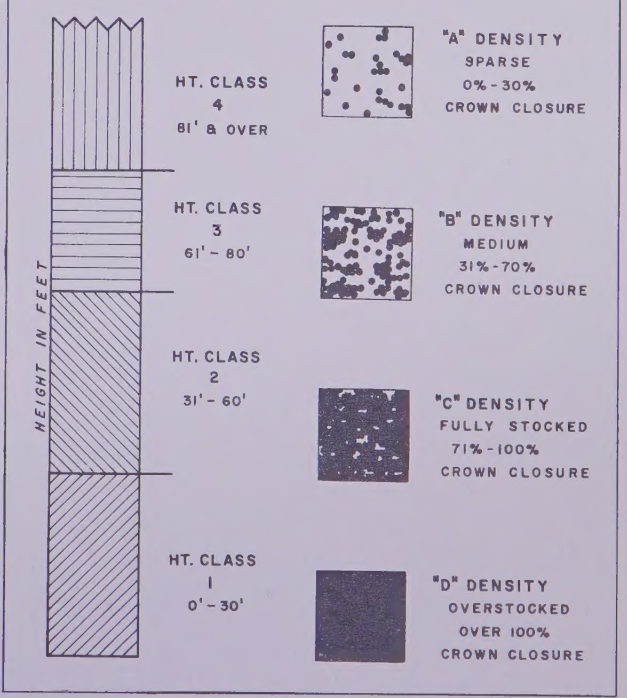
The forest classifications were transferred from the photographs to the maps by simple instruments such as the Seelyscope, Sketch-master and the Multiscope. The original of the final map was then prepared by draughting the information onto translucent film. In the northern Alberta inventory draughting was done at a scale of 1:40,000 with photographic reductions at 1:63,360. The scale employed for these original maps in the Reserve inventory was 1:15,840.

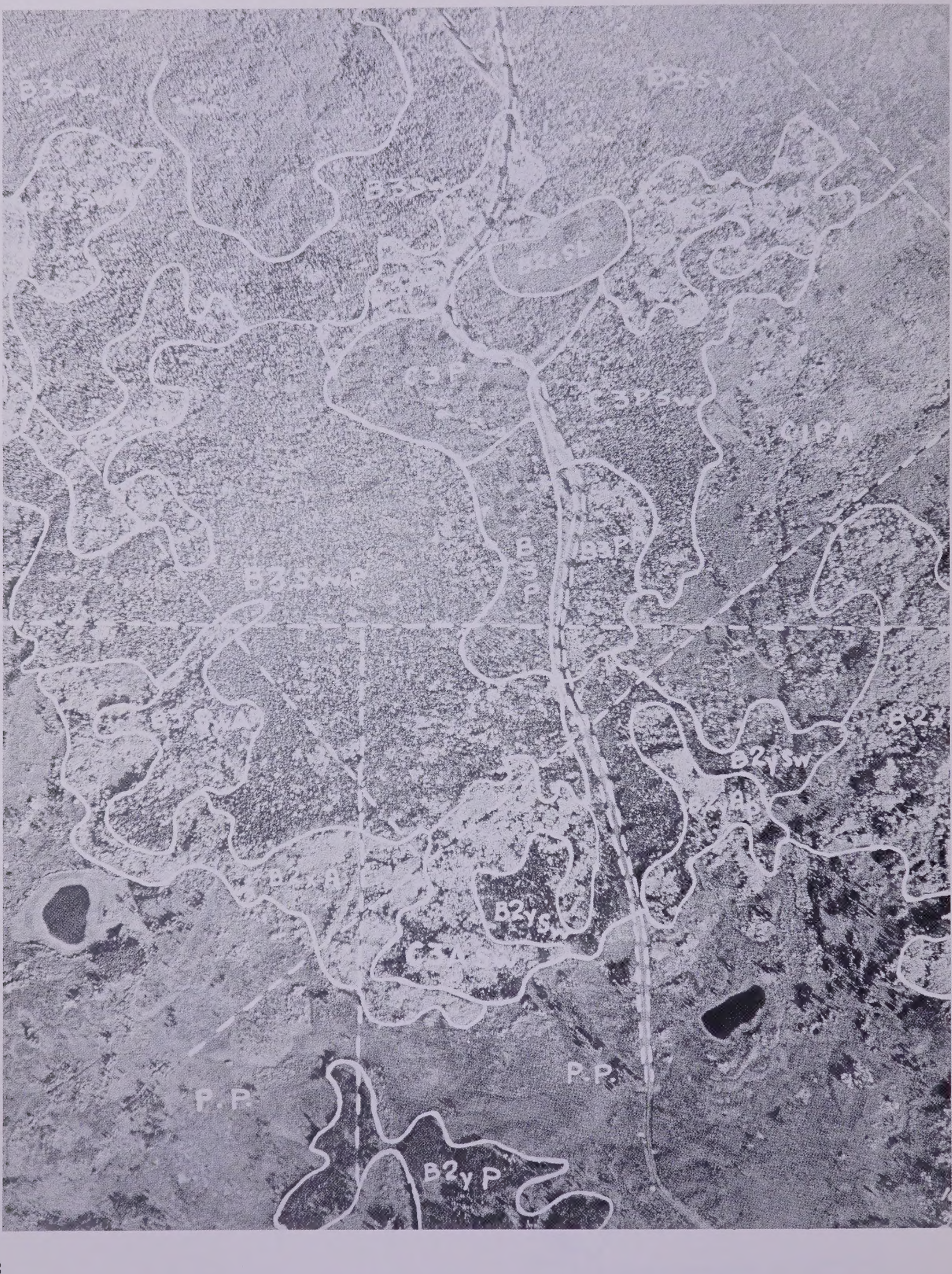
The area covered by each forest type on each base map was measured by such methods as a planimeter, dot count overlay or areameter. The last of these instruments was developed by Departmental staff.

During the summers, 1950 to 1954, field workers tallied a total of 21,000 plots either 1/10 or 1/4 acre in size. A total of 2,000 plots were also measured in the Rocky Mountains Forest Reserve inventory. Timber volume information obtained from plots formed the basis for the calculation of stand volume tables. Volume was recorded as the number of cubic feet of timber per acre, written as cunits per acre. Separate volume tables were made

Fig. No. 1

HEIGHT & DENSITY CLASSES




B3Sw
B3Sw
B3Sw
B2xSb
C3P
C3PSw
C1PA
B3SwP
B2ySw
B2ySw
C3ASw
P.P.
P.P.
B2yP

for each zone and each possible forest type in the zone. The forest type volume was broken down into the following components:

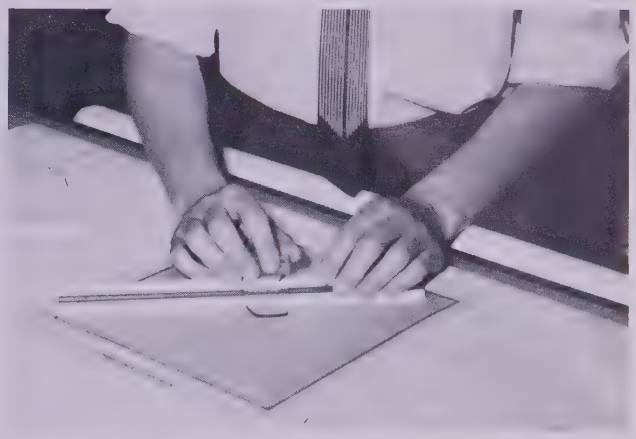
White Spruce	—	4″ to 9″ D.B.H. (Diameter Breast Height)
White Spruce	—	10″ D.B.H. and up
Black Spruce	—	4″ D.B.H. and up
Balsam Fir	—	4″ D.B.H. and up
Pine	—	4″ to 9″ D.B.H.
Pine	—	10″ D.B.H. and up
Deciduous	—	4″ D.B.H. and up

To obtain the volumes for each map sheet it was necessary to multiply the acreage of each forest type by the corresponding stand volume table value. South of the 57th parallel these calculations were done by conventional methods using electrical calculators. North of the 57th parallel and in the Reserve most of the calculations were done by International Business Machine electrical impulse and electronic machines which proved to be considerably faster and more accurate.

Because I.B.M. equipment was available the whole inventory has been set up on a punch card system. Within the limits of the inventory specifications the cards can be sorted and summarized in any desired combination. Using this system it is unnecessary to keep libraries of reports on hand since any required data can be readily obtained in concise statements.

The maintenance of the forest inventory has also been considerably simplified by use of the punch card system. Since the forests are constantly changing, it is necessary to record major disturbances which would alter the extent, conditions or volumetric data of the forests sufficiently to detract from the usefulness of the inventory.

Areas burned by forest fires which exceeded 160 acres in size have been photographed in order to correct the forest cover maps and the statistical data involved. Accurate records are kept of the timber that is cut annually although the maps are not revised specifically for this depletion. However, the inventory volumes of any given area can be readily adjusted. It is expected that growth data will be applied to the inventory to balance depletion. By a combination of periodic re-photography and consideration of the changes that occur in the forest conditions, the inventory will be maintained within the limits of its application. It will continue to provide a reliable analysis of the total forest resources for many years.



AREAMETER

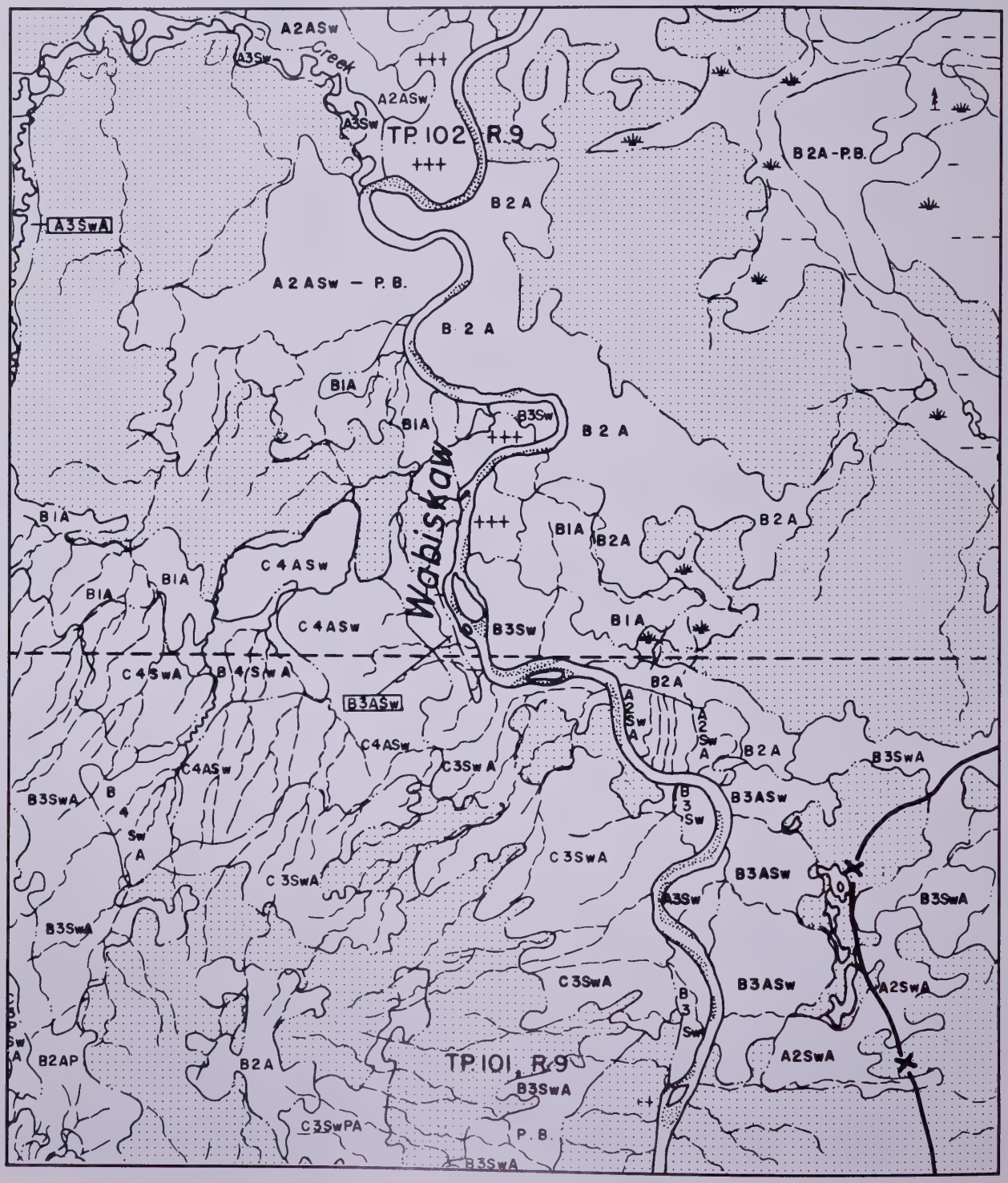
POCKET STEREOSCOPE

MODIFIED INFRA RED

PANCHROMATIC

MAP NO. 2

INVENTORY FOREST COVER MAP



APPLICATION OF THE RESULTS

Although it provided results only on a broad basis, the forest inventory is a major basis for the administration of Alberta forest resources. The photographs, maps and statistics provided by the inventory have already been valuable tools to Government administrators and officers, timber operators, oil companies, Royal Commissions and many other organizations that required such data in order to proceed with plans of development and utilization in their particular fields.

In forestry the inventory information has been of particular value in assessing the best use of land, in planning the development of the forest industry and in organizing improved forest protection from destructive agencies, particularly fire. Invariably the principal objective of a forest management program is to maintain maximum forest production on a sustained yield or permanent basis. This policy governs the development of Alberta forests today and is the basis for the legislation which determines the disposal of timber and protection of the forest lands. The implementation of a complete sustained yield program is costly. Therefore one of the first applications of the inventory information was to determine which forested areas should be placed under permanent management and to select suitable boundaries.

1. *Land Use Classification*

There are two major uses of land in Alberta, forestry and agriculture. In some areas other uses may become important and occasionally they attain primary status. Preliminary steps towards defining what parts of the Province were suitable for agriculture and what areas were suitable for forestry purposes were taken in 1948. In addition to the completely settled area in the southeast part of the Province, the land area was separated into two zones, one zone being classified as open for agriculture settlement and the other reserved for forest land and closed to settlement. The boundary was considered as a fixed line until further studies could be conducted to determine arability of land for agricultural development. It was fully realized that adjustments would be necessary but the boundary provided a temporary deterrent to ill conceived settlement and consequent demands for impractical social services.

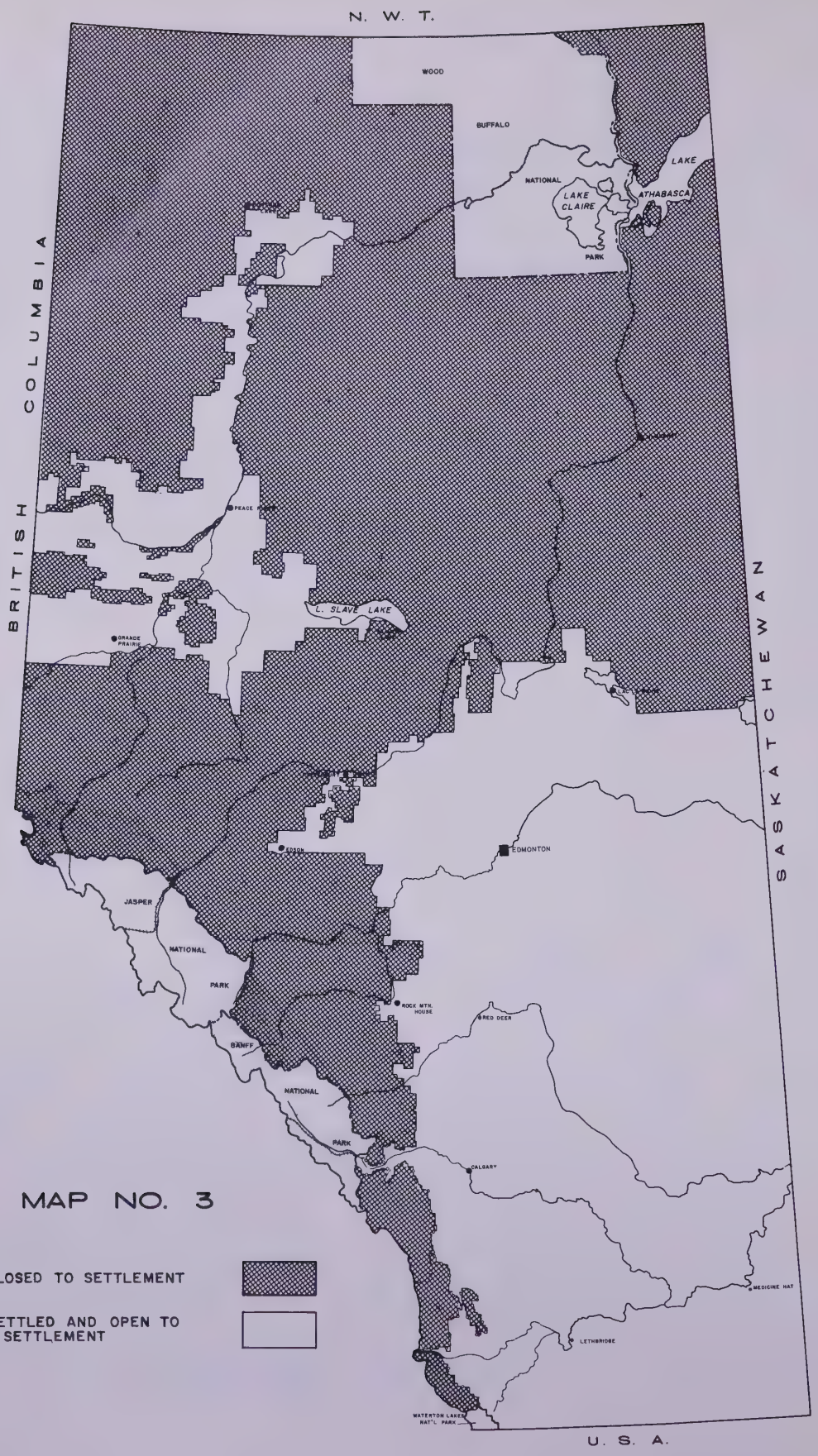
A program to define potential agricultural areas was undertaken in 1955 by the Alberta Research Council and completed in 1964. Council staff have completed preliminary classification of most of the doubtful areas of the Province and made extensive use of the inventory maps and photographs to do this work. In remote areas a helicopter was used to land soil experts who obtained soil samples for analyses of arability. As a guide, land form maps were first prepared from aerial photographs since the nature of topography and class of drainage are important factors in deciding the suitability of land for agricultural use. As this program developed the boundary between the forest zone and potential agricultural zone was revised in blocks. Wherever definition of the exact boundary was doubtful, the aerial photographs were carefully examined and obvious discrepancies adjusted.

A similar procedure has been employed to identify the forest area that will be permanently managed for timber production. If no soil information of any description is available aerial photographs are used to determine the border between land suited and unsuited for permanent forest land. In this way it has been possible to reliably indicate what can be operated under sustained yield forest management.

2. *Timber Regulation*

Using the information available from the forest inventory, the forested area of the Province has been divided into convenient units for the application of sustained yield principles. The size, shape and location of the units are determined on a basis of existing boundaries of administration, watersheds, availability of the inventory information by base map areas, accessibility, probable timber extraction routes and permanent forest land boundaries. Other factors are considered in some instances.

Included in the inventoried area of the Province are eleven regions of administration known as Forests. They are the Athabasca, Bow River, Clearwater-Rocky, Crowsnest, Edson, Footner Lake, Grande Prairie, Lac La Biche, Peace River, Slave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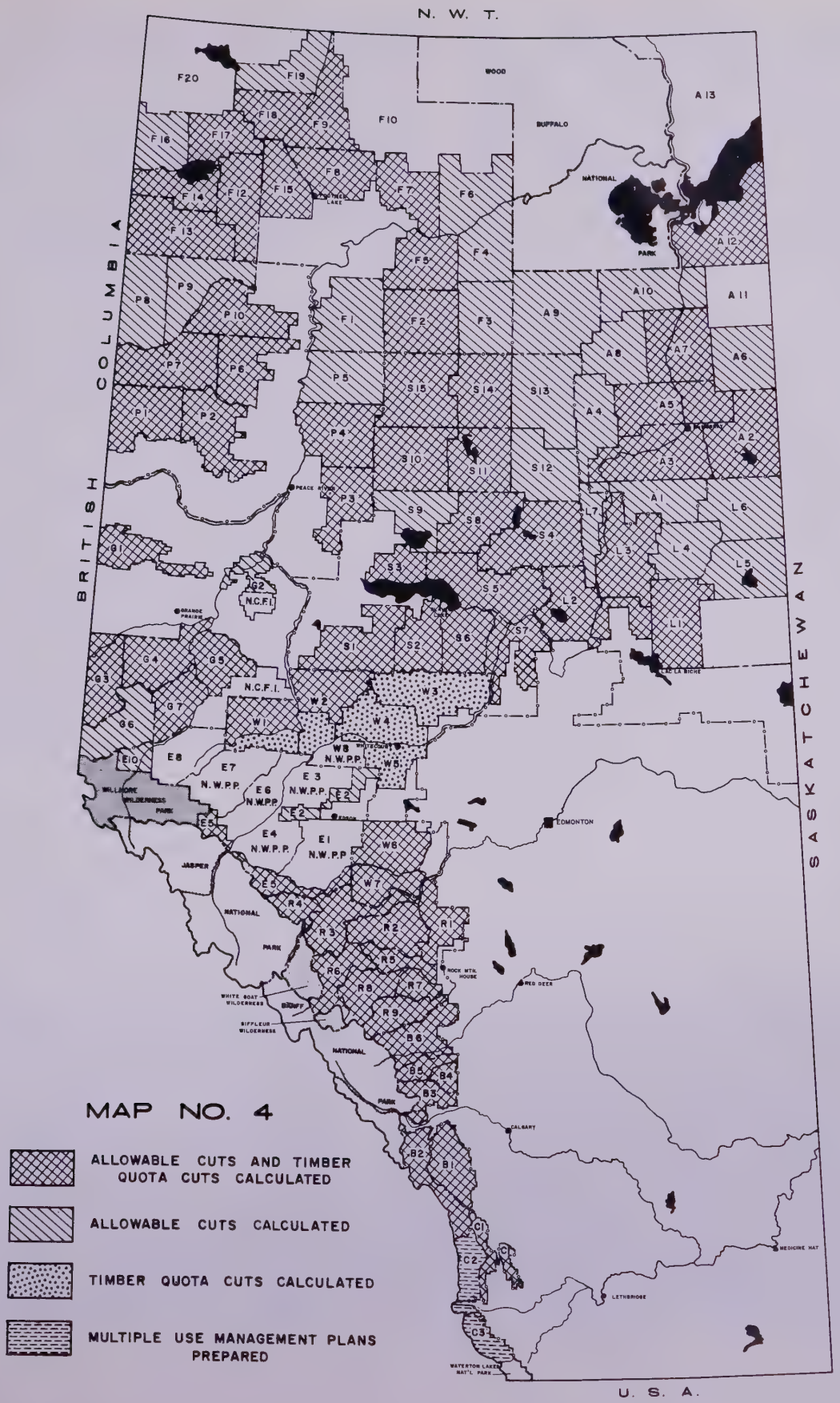
RED DEER
BANFF
NATIONAL
PARK
CALGARY
MEDICINE HAT
LETHBRIDGE
WATERTON LAKES NAT'L. PARK
U. S. A.
MAP NO. 3
LANDS CLOSED TO SETTLEMENT
LANDS SETTLED AND OPEN TO SETTLEMENT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BRITISH COLUMBIA
SASKATCHEWAN
U. S. A.
MAP NO. 4
ALLOWABLE CUTS AND TIMBER QUOTA CUTS CALCULATED
ALLOWABLE CUTS CALCULATED
TIMBER QUOTA CUTS CALCULATED
MULTIPLE USE MANAGEMENT PLANS PREPARED
EDMONTON
CALGARY
RED DEER
MEDICINE HAT
LETHBRIDGE
GRANDE PRAIRIE
PEACE RIVER
JASPER
NATIONAL PARK
WOOD BUFFALO NATIONAL PARK
WILLMORE WILDERNESS PARK
WHITE GOAT WILDERNESS
BRAZEAU
BIFFLEUR WILDERNESS
WATERTON LAKES NAT'L PARK
N.C.F.I.
N.W.P.P.
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F19
F18
F9
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C1
C
C2
C3

Lake and Whitecourt Forests. Each Forest has been divided into management units. These units average 1,000 square miles in size. Units within a Forest are numbered and prefixed by the first initial of the Forest. Thus Unit P-1 is the Peace River Forest Management Unit number one and S-5 is the Slave Lake Forest Management Unit number five.

The inventory information available for these units was used to calculate a long range allowable annual cut for each management unit in the Province. This cut indicates the volume of timber that can be removed annually from a unit to produce a sustained yield of forest products. A comparison of these cuts with past and current timber production indicated that the white spruce species, the backbone of the Alberta sawmilling industry, was being heavily overcut in some areas and undercut in others. This comparison also showed that jack and lodgepole pine, timber species also suited for saw-timber, were not being utilized in spite of the large volume of this species that exists in the Province. Measures were put into effect to remedy this situation, culminating with the introduction of the timber quota system in 1966. In this system an annual quota of white spruce and pine saw-timber is established for each forest management unit where a demand for saw-timber exists. This quota is related to the allowable annual cut and timber operators in the unit are assigned a portion of the unit's saw-timber quota in accordance with their past timber production. It is planned, through this quota system, to utilize the province's forests in accordance with their productive capacity and thus to insure a perpetual supply of timber for the future.

3. *Protection Planning*

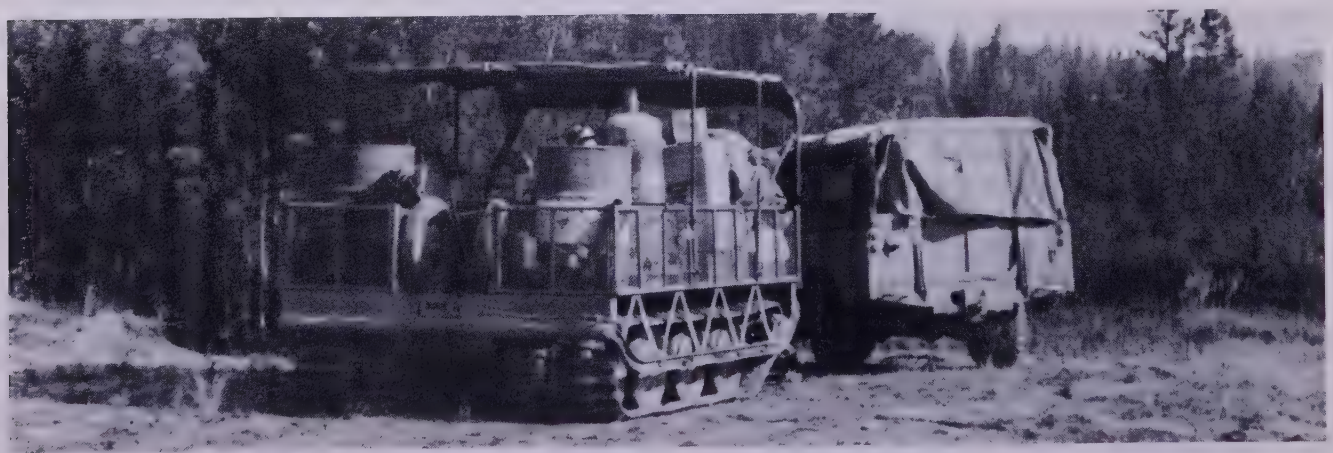
Forest cover maps at reduced scales provide the basis for much of the forest protection planning. They have permitted the detection of high value and risk areas. As a result, new access roads and lookout towers are located for more significant fire protection. Forest value is considered when planning the location of aerial fire patrols. Forest cover maps are used constantly by field personnel to assist them in planning the control of forest fires.

The inventory maps disclosed, in some cases for the first time, the severe damage that had been caused by fire in the remote inaccessible areas of Northern Alberta. Fire protection is being extended proportionately to include an expanded program of lookout construction, personnel establishment, road building, equipment purchase and increased use of aircraft both for fire patrol and access to fires. Alberta takes action on all fires in the forested area of the Province.

4. *Development*

The inventory has uncovered new areas of timber suitable for development of both the sawmill and pulpwood industries. Logging has extended quite considerably since inventory maps became available, and the interest of pulp companies has become intensive. Many large regions of forest growth appear to be more suitable for pulpwood harvesting, particularly the areas that have abundant pulpwood size pine. The inventory also revealed vast resources of deciduous timber. One large pulp company and three plywood companies have become established and the inventory proved to be very valuable in organizing and developing their programs.

In several cases planning for other industrial development in the Province has included the information available from the forest inventory. Several commissions conducting transportation and economic surveys obtained, by these means, a comprehensive picture of the relationship between forest resources and industrial expansion in Alberta.



FOREGROUND — "BOMBARDIER" TRACK VEHICLE

PHYSICAL GEOGRAPHY OF THE FOREST AREA

1. *Climate*

The climate of Alberta is predominantly continental. Most of the air that circulates over the Province comes either over the mountains from the Pacific Ocean or from the north and north west by way of the Mackenzie Basin. Alberta receives only an insignificant amount of warm air from the Mississippi Basin although this air does penetrate into Saskatchewan and Manitoba.

The mountains to the west are very effective in moderating the weather of the Province. Low pressure "fronts" from the west may give rise to warm "chinook" winds while the main mass of cool or cold air, flowing from the north or north west, is thereby steered eastward. Modification of cold outbreaks is likely to appear in Alberta before it occurs in prairie regions to the east. However, despite these influences, very cold air does grip the whole of the Province for extended periods.

Within the Province there is considerable variation in climate. Generally, at the same latitude, the western parts tend to be warmer than the eastern portions and there are considerable variations in the north-south direction. In the winter the temperature gradient from south to north is steep but in the summer it is very slight. Thus summer temperatures are not as limiting to growing conditions in northern areas as the latitude might indicate.

In the south-east part of the Province the growing season is semi-arid characterized by an average annual precipitation of 11 to 13 inches, frequent drought, high evaporation and frequent hot dry winds. In the west central part of the Province the annual precipitation approximates 20 inches, temperatures are cooler, evaporation lower and the growing season shorter. In the extreme north of the Province precipitation decreases to about 12 inches per year, temperatures are even cooler and evaporation lower.

Generally the more prolonged and widespread rains in the Province are caused by relatively warm maritime air from the Pacific crossing the mountains and converging with the drier, cooler continental air from the north. This Pacific air is relatively unsaturated after crossing the mountain barrier and is lifted by the Polar air which, because it is cold and dense, flows underneath. On rising, the Pacific air becomes chilled to temperatures suitable for the condensation of its moisture which falls as rain. Some heavy rains in the south and east portion of the Province may be due to a similar association of warm, moist air from the Mississippi Basin and cold Polar air. Heavy showers and rains of short duration, which are particularly common during the summer, are often caused by Pacific, Tropical or even Polar air being warmed on passing over the land. Such air becomes unstable and upon

Table No. 1

MONTHLY PRECIPITATION

	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Total*
Calgary	0.55	0.66	1.12	1.26	1.94	3.48	2.41	1.96	1.79	0.89	0.79	0.62	17.47
Coleman	0.98	1.24	1.44	1.42	1.93	2.76	1.51	1.46	1.79	1.62	1.83	1.75	19.73
Edmonton	0.90	0.77	0.85	1.10	1.82	2.97	3.11	2.27	1.16	0.84	0.91	0.93	17.63
Edson	0.91	0.68	0.98	1.05	1.82	3.34	3.53	2.99	1.65	0.84	1.18	0.94	19.91
Embarras	0.96	0.69	0.76	0.72	1.27	1.49	1.90	2.33	2.20	1.14	1.03	0.93	15.42
Fort Vermilion	0.71	0.66	0.74	0.61	1.36	1.67	1.87	1.66	1.27	0.61	0.74	0.86	12.76
Grande Prairie	1.51	1.28	1.17	0.84	1.41	2.33	2.57	1.75	1.62	0.85	1.52	1.45	18.30
Keg River	0.72	0.76	0.72	0.76	1.80	1.76	2.16	1.74	1.40	0.98	1.09	1.06	14.95
Lac La Biche	1.07	0.69	0.76	0.80	1.80	2.47	2.92	2.42	1.36	0.90	1.08	1.03	17.30
McMurray	0.83	0.62	0.85	0.77	1.39	2.11	3.08	2.25	1.67	0.97	0.95	0.83	16.32
Peace River	0.83	0.72	0.60	0.51	1.09	2.11	1.86	1.70	1.32	0.92	0.75	0.74	13.15
Rocky Mtn. House	0.88	1.00	0.95	1.48	2.46	3.82	3.89	3.52	1.95	1.04	0.79	0.92	22.70
Slave Lake	0.99	1.05	0.92	0.91	1.72	2.38	2.87	2.33	1.71	1.15	1.08	1.04	18.15
Wagner	1.03	0.95	0.50	0.97	1.54	1.97	2.81	2.78	1.23	0.78	1.06	1.16	16.78
Whitecourt	1.32	1.00	0.84	1.30	2.09	2.77	3.94	3.29	1.42	0.74	0.80	1.00	20.51

cooling loses its moisture by condensation which may fall as rain.

Because of the chinook and the effect of the western mountain barrier on the large scale weather systems, the wind pattern over Alberta is complex. Winds may vary markedly in speed and direction over short distances. The south-western part of the Province exceeds all others in total miles of wind per year, the "blows" of short duration being both numerous and strong.

Since the strong, warm, drying chinook winds from the west only originate under certain conditions, they follow favorite tracks from which they burst forth at high speeds. Their speed decreases fairly rapidly as they move eastward. These winds are most frequent in the south west, less frequent north of Calgary and again become rather common in the upper Peace River region. In all western sections of the Province, however, they occur often enough to have a considerable effect on the climate.

2. *Topography*

The most prominent topographic feature of Alberta is the range of Rocky Mountains on the west side extending from the south border to a point about midway between the north and south boundaries of the Province. The elevation gradient varies, falling away rapidly at first from altitudes of 10,000 feet to 3,000 feet above sea level at the eastern fringes of the foothills. East and north of the foothills the topography changes to gently rolling plains at altitudes of approximately 2,000 feet decreasing to 700 feet at the northern boundary. The plains area is broken by some prominent ranges of hills which, in a few cases, rise to altitudes of 4,000 feet. Outstanding among these are the Swan hills in central Alberta and the Cypress hills in the south east corner. Other examples are Martin Mountain, Caribou Mountains, Clear Hills, Buffalo Head Hills and Birch Mountains. These features generally extend 1,000 to 2,000 feet above the level of surrounding terrain. Generally the elevation of most of Alberta's forests lie between 1,500 and 2,500 feet. However the prominent hills noted above feature valuable forest cover significantly different than that found at lower elevations.

Other relief features are the valleys of the major rivers including the South Saskatchewan, the Bow, the Red Deer, the North Saskatchewan, the Athabasca and the Peace, together with their main tributaries. The drainage pattern is from west to east in the southern part of the Province and from south west to north east throughout the northern part.

Large bodies of water are rare in the forested area. Lesser Slave Lake in the center of the Province and Lake Claire and Lake Athabasca in the north east corner bordering the Precambrian Shield, are the only prominent lakes exceeding 400 square miles in area. There are many smaller lakes scattered throughout the Province but a large percentage of those in the north are shallow and surrounded by muskegs.

The uppermost bedrock throughout the major portion of Alberta is of the Cretaceous Age. Precambrian formations are found in the extreme north east portion and the Tertiary Age is represented mostly in the western part of the Province. Almost the whole area of Alberta is covered by a mantle of glacial drift that resulted from the recession of two major ice sheets. As a result of wind and water action, there are now large alluvial, aeolian and lacustrine areas.

Extensive bog or muskeg conditions exist throughout the northern part of the Province. These muskegs generally resulted from the beds of former glacial lakes.

3. *Soils*

About three-quarters of the land area of Alberta lies in the Grey Wooded (and other podzolic) soil zone which approximates the present range of forest cover. The map of soil zones prepared by the Soil Surveys of the Research Council of Alberta illustrates the distribution of the major soil types in the Province. The brown, dark brown, thin black and black zones are essentially grassland areas. However, forest cover, mainly deciduous, has partially invaded the black zone and has been responsible for the term "parkland" being applied to this area.

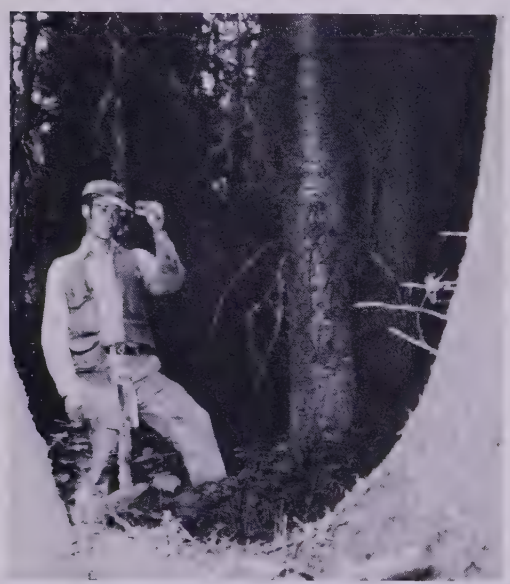
The degraded black transition zone is mostly wooded with frequent coniferous growth. The grey wooded zone, including podsolized grey wooded and organic soils, supports almost all of the forest cover in the Province. Moss bogs (muskegs) and sedge bogs are common. Because of the tree cover, cooler temperatures, lower evaporation and shorter growing season, the soils here have developed under

humid soil moisture conditions. The surface soil horizon usually consists of semi-decomposed leaf litter that may be absent if the area has burnt over; a thin grey-black, brown or grey-brown horizon below the leaf litter and a severely leached and platy, greyish horizon with an average depth of 6 to 8 inches. The accumulation horizons are heavy textured, compact and often darker in color than the surface horizon. The depth of lime accumulation is quite variable but is generally three to four feet below the surface.

The soils are not very fertile in the forested area because of leaching. They are low in nitrogen and organic matter and frequently deficient in sulphur and phosphorous.

Although a large amount of forest products has been produced in the degraded black zone in the past, these areas presently contain very little commercial timber. In many areas they will continue to supply small operators and farmers with their requirements. The grey wooded zone contains all of the large timber operations and will continue to do so. However, it is quite apparent that most of the future expansion in agricultural development will necessarily be into the grey wooded zone. In time this may have a significant effect on the timber producing capacity of Alberta. The Soil Survey classification of the area is of great assistance in determining the probable areas of expansion of agriculture.

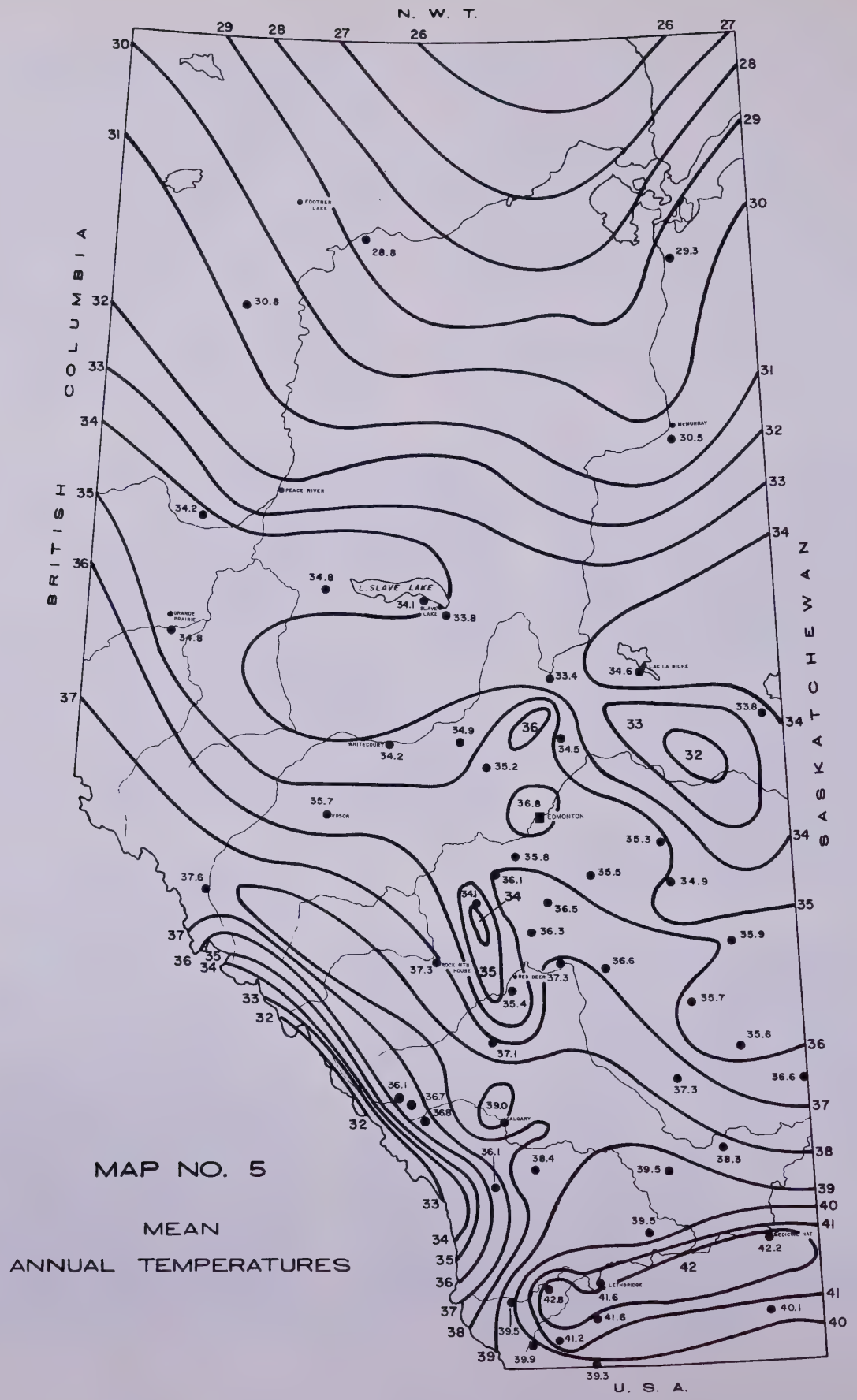
VOLUME SAMPLING — WEDGE PRISM



SEELYSCOPE

RECORDING DATA

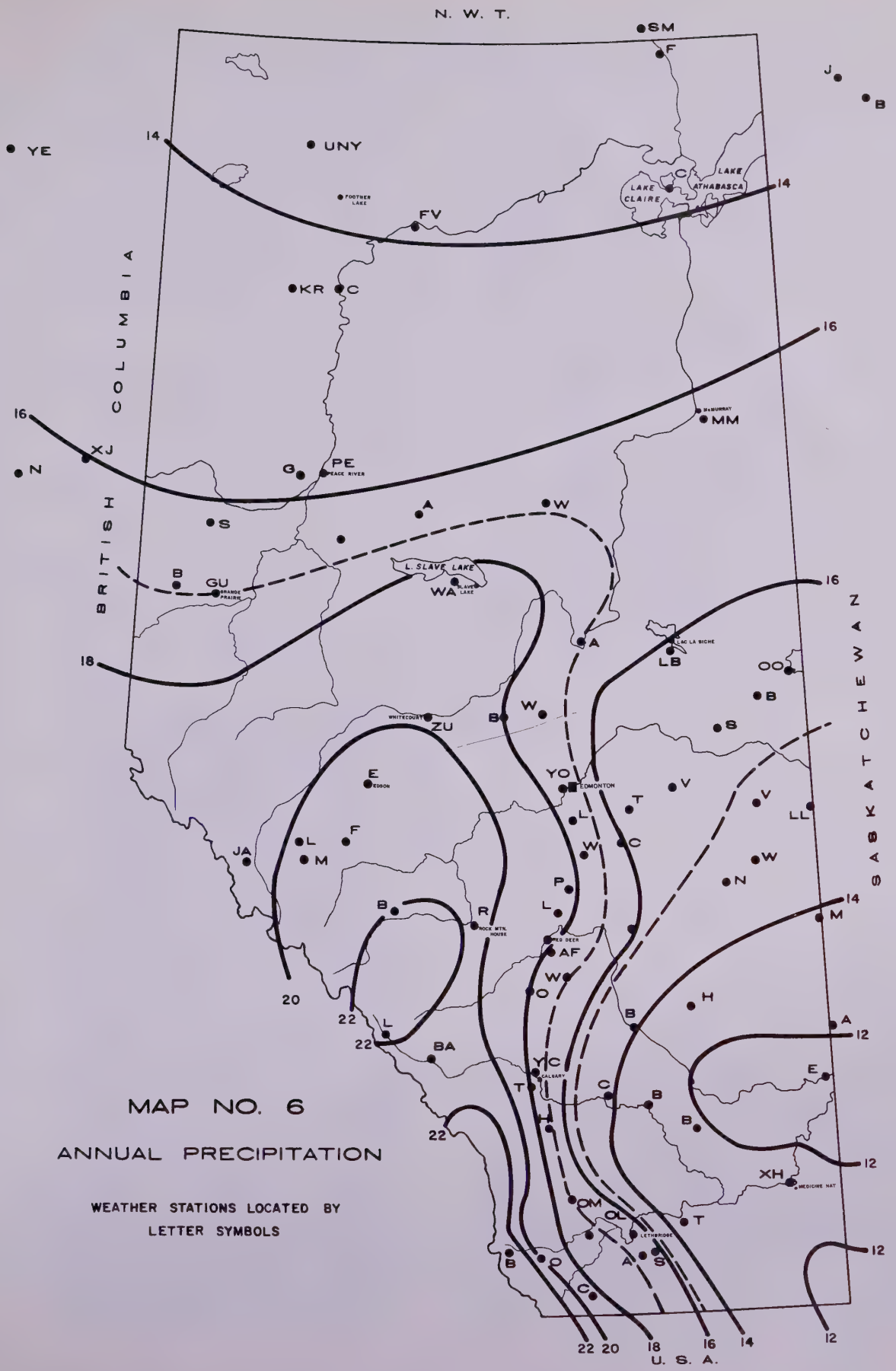
VOLUME SAMPLING — ABNEY LEVEL



MAP NO. 5

MEAN

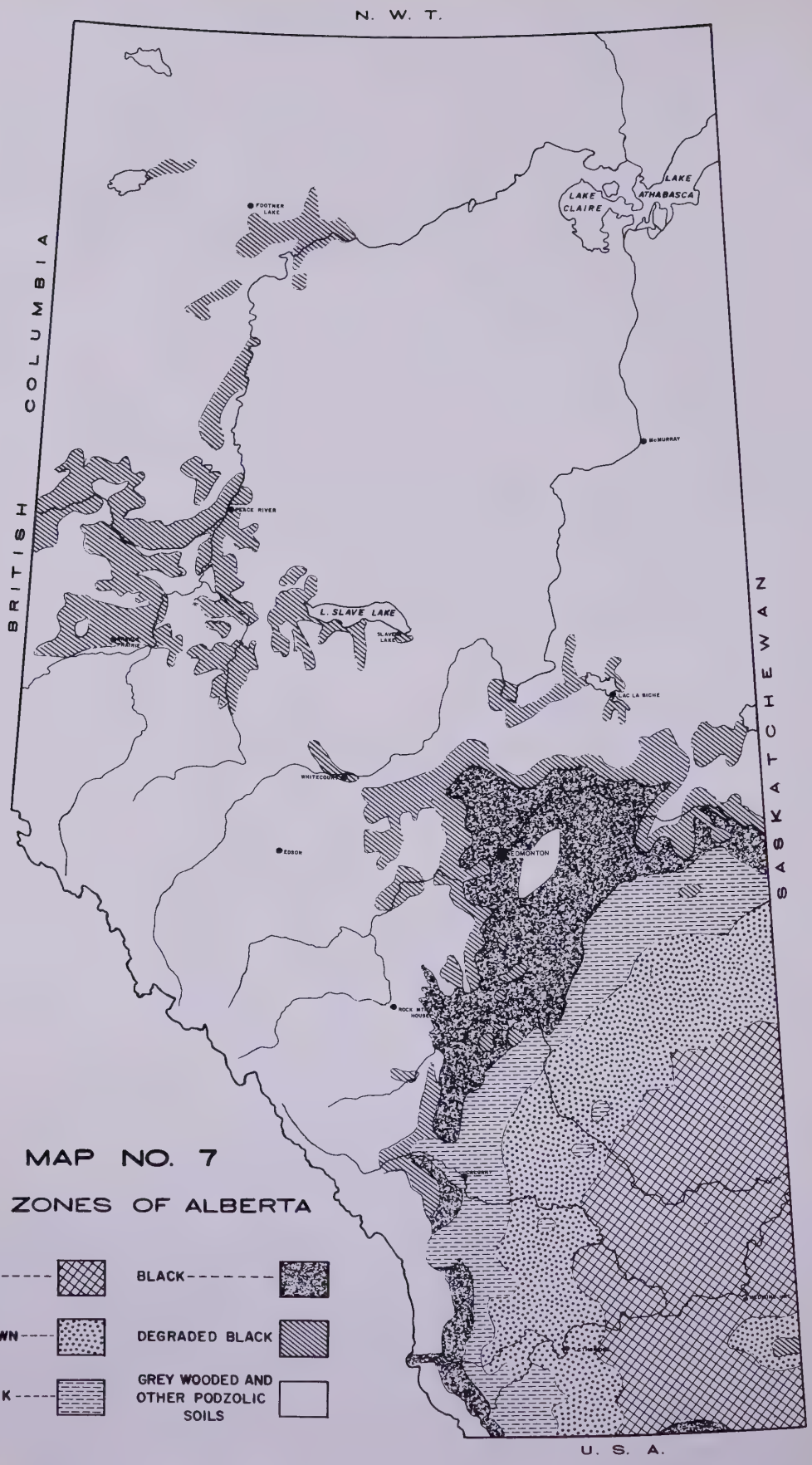
ANNUAL TEMPERATURES



MAP NO. 6

ANNUAL PRECIPITATION

WEATHER STATIONS LOCATED BY LETTER SYMBOLS


N. W. T.
BRITISH COLUMBIA
SASKATCHEWAN
U. S. A.
FOOTNER LAKE
LAKE CLAIRE
LAKE ATHABASCA
McMURRAY
PEACE RIVER
L. SLAVE LAKE
SLAVE LAKE
GRANDE PRAIRIE
LAC LA BICHE
WHITECOURT
EDSON
EDMONTON
ROCK MT. HOUSE
CALGARY
MAP NO. 7
SOIL ZONES OF ALBERTA
BROWN
DARK BROWN
THIN BLACK
BLACK
DEGRADED BLACK
GREY WOODED AND OTHER PODZOLIC SOILS

FOREST CLASSIFICATION OF ALBERTA*

The forests of Alberta are included in the broad system of regional classification of Canadian forests. Each region is a major geographic belt or zone that has similar characteristics of vegetation. The regions are subdivided into sections which are geographic areas relatively the same as other sections but possessing individual vegetative and physical geographic patterns. Conspicuous tree species and obvious topographic conditions are often criteria of sections.

Alberta forms part of three of the major regions, Boreal, Subalpine and Montane. The Boreal Region comprises the greatest part of Canada's forested area. In Alberta it includes almost all of the area classified as forest land with the Subalpine and Montane Regions confined to the east slopes of the Rocky Mountains.

Generally the Boreal Forest Region in Alberta is characterized by the presence of white and black spruce; with jack pine, lodgepole pine, balsam fir, alpine fir and tamarack as less common or more local coniferous species. There is a general admixture of trembling aspen, balsam poplar and white birch throughout most of the area.

The sections of the Boreal Region present in Alberta are described as follows:

Section 18a — Mixedwood Section —

This is an area covering most of the north central part of the Province characterized by an abundance of aspen mixed in varying proportions with balsam poplar, white birch, white spruce, and balsam fir. The low areas and upper water catchments develop black spruce and tamarack under muskeg conditions. Jack pine and some lodgepole pine enter the mixtures along fringes and on drier till soils and mix with black spruce on the plateaux of higher hills. The topography is generally rolling without severe relief and the soil is grey-wooded.

The mixedwood section provides an environment that encourages the growth of white spruce. Wherever spruce seedlings may become established the young trees grow well under the protection of a deciduous canopy. Aspen regenerates readily after disturbances such as fires but in most areas it is gradually replaced by white spruce as the aspen becomes older and deteriorates. Unfortunately, frequent large fires in the past have kept the size of coniferous timber below merchantability and the section does not support much mature timber. Accessibility into the area has been very limited so that large sections of it have not been exploited.

Section 18b — Hay River Section —

This section is actually a northern extension of the mixedwood forest. The climate is more severe with colder weather and less precipitation and the topography is generally more level. Forest growth is poorer than that to the south and the amount of white spruce mixed with poplar is less. Black spruce covers a large part of the area both in its typical lowland location and on upland plateaux where it is frequently mixed with lodgepole pine. Jack pine is abundant on the east side of the Hay River section but decreases toward the west.

Cretaceous sedimentary rock underlies most of the section, though in the escarpment area on the north and east the bedrock is of Devonian age and largely limestone.

B19a — Lower Foothills Section —

This section represents an area of transition between the Boreal and Subalpine Regions. Consequently most of it is located in the Rocky Mountain foothills with small outlying areas such as the Caribou Hills, Pelican Mountains and Cypress Hills east of the main body. Generally, the elevation of these foothills is 3,000 to 4,000 feet but this decreases to 2,500 feet where the average elevation of the general terrain is lower. Lodgepole pine is the dominant species, largely the result of past fires. Aspen and balsam poplar are common and white spruce is a valuable addition in older stands. Black spruce, white birch and tamarack occur throughout the area in their appropriate habitats. Both balsam fir and alpine fir occur in the main body of the Section but because of their poor commercial quality they are of little importance.

The topography is rolling, with some plateau areas among low to high rounded hills. The main rivers flow eastward in broad, sharply defined valleys.

*"Forest Regions of Canada" by J. S. Rowe, Canada Department of Northern Affairs & National Resources, Forestry Branch—Bulletin 123.

B19c — Upper Foothills Section —

This is a long narrow strip of land parallel to the front range of the Rocky Mountains which represents the western part of the transition from boreal to subalpine forest. The foothills reach 6,000 feet in elevation and are forested almost entirely with conifers. Deciduous species are uncommon except for patches of stunted trees on exposed valley slopes. Lodgepole pine is again the predominant species with white spruce also present in major proportions. Black spruce is quite common, there is some alpine fir and tamarack is scarce.

The Section is composed mostly of high rounded hills and deep valleys.

B22b — Athabasca South Section —

A small area in north eastern Alberta is characterized by sandy soils derived by glacial action from underlying sandstones. Jackpine covers almost all of the area although in terms of present requirements, it is of unmerchantable size because of the severe climate and frequent fires. The moister sandy flats and fine textured soils support black spruce and tamarack. The poplars and white spruce are found in limited quantities along valleys and lake shores. Balsam fir occurs to some extent in the southern part of the section. Generally the area is a broad lowland with occasional deeply cut river valleys.

B23a — Upper Mackenzie Section —

Only a very small part of this section is contained in Provincial forest land, most of the Alberta portion being in Wood Buffalo Park. On alluvial flats of the river valley white spruce and balsam poplar form the main cover types with some balsam fir and white birch being present south of Lake Athabasca. On the benches above the flood plains the large areas of sandy soils support jack pine and aspen, while black spruce and tamarack occupy the moist to wet positions.

B17 — Aspen Grove Section —

This section in the vicinity of Edmonton, is a transition zone between grassland and forestland. A few scattered patches are also found in the Peace River area. Aspen is the predominant species with balsam poplar and some white birch being present. In this section there is a notable gradation in heights of mature stands from the prairie to forest area.

Topography is variable but generally rolling. The section corresponds quite closely to the black and degraded black soil zones.

B27 — Northwestern Transition Section —

In the extreme northeast region of the Province there is a small transition area between the forest and the open subarctic woodland. Because of severe climate, thin soils and frequent fires the distribution, abundance and size of the trees are reduced. Open stands of dwarfed trees are intermixed with bog, muskeg and barren rock. Black spruce is the most common species while white spruce grows with it on the most favourable soils. White birch, tamarack, jack pine, aspen and balsam poplar are also present.

The Subalpine Forest Region —

The East Slope Rockies Section of the Subalpine Forest Region covers the south west part of the Province on the eastern slopes of the Rocky Mountains and adjacent rugged foothills. The elevation of the section is approximately 5,000 to 6,800 feet. This is a coniferous forest area distinguished from the Upper Foothills of the Boreal Forest by the presence of Engelmann Spruce and the Engelmann-white spruce hybrid combination. Lodgepole pine is a very important major species because of its ability to regenerate readily following fires. In many areas it has replaced spruce. Alpine fir is abundant at higher altitudes, especially in the older spruce stands. Towards treeline on rocky ridges and exposed slopes, whitebark pine is found in the southern areas. Limber pine and alpine larch occur under similar conditions in a few scattered locations. A small amount of Douglas fir is present on the fringe of the Subalpine-Montane Forest boundary.

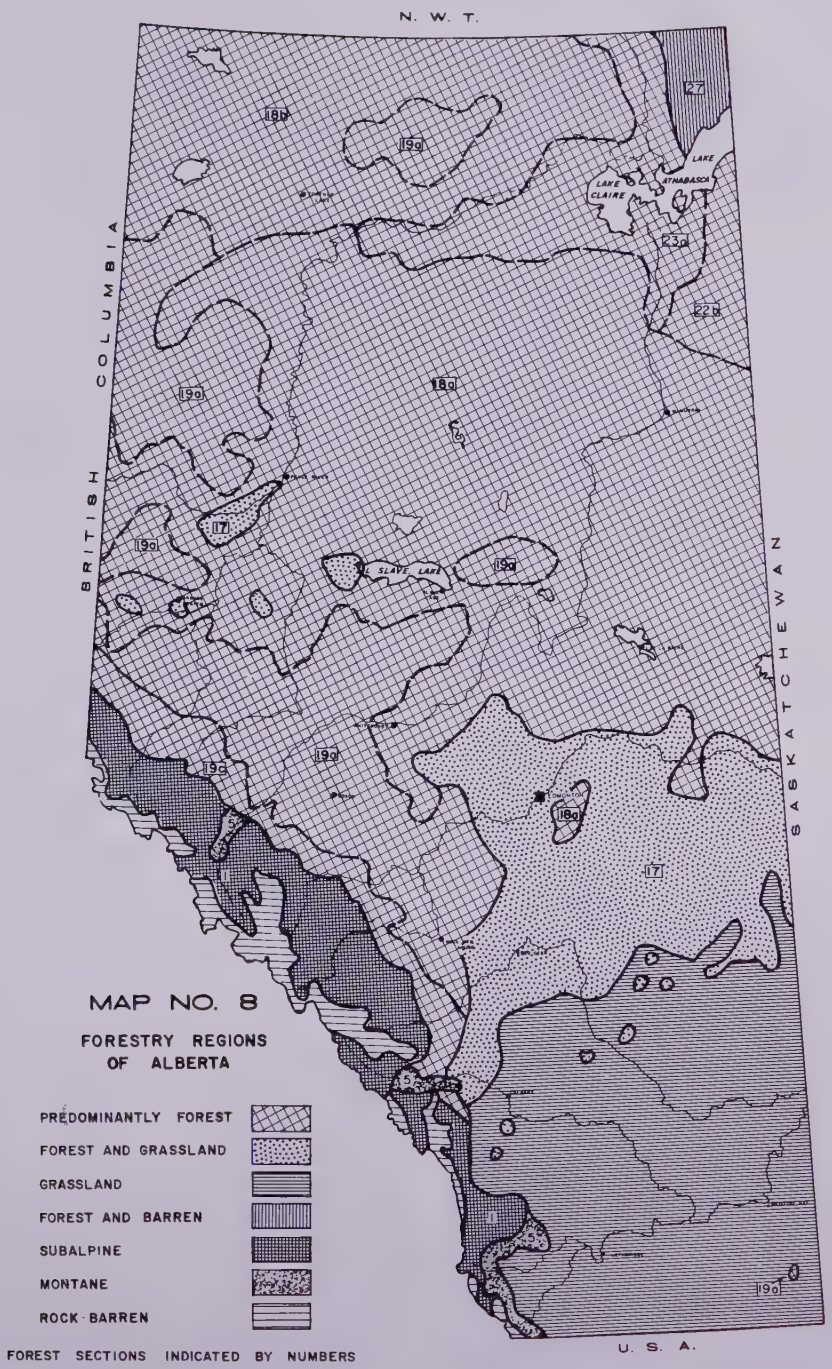
The Subalpine and Boreal forests show close relations in primary species. Engelmann spruce is mated by white spruce, alpine fir by balsam fir and lodgepole pine to some extent by jack pine. Each pair of species overlap in their ranges and apparently hybridize in the transition areas. However, the poplar species, white birch and black spruce are uncommon in the Subalpine Forest and of little significance.

The Montane Forest Region

The Douglas Fir and Lodgepole Pine Section of the Montane Forest occurs in four small patches on the east slopes of the Rocky Mountains. One area is found in the Porcupine Hills-Waterton Lakes

district, one on the Bow and Kananaskis Rivers west of Calgary, one in the upper limits of the North Saskatchewan River and the fourth on the Athabasca River around Jasper. The last three areas are not too obvious and of little significance in Alberta's forest industry.

The stands of Douglas fir and lodgepole pine are mostly confined to warm, dry slopes, while the northern slopes and moister shaded sites are dominated by white spruce. Engelmann spruce, alpine fir and some limber pine appear at the higher altitudes.



AREA CLASSIFICATION

The Crown lands that have been inventoried are divided into three broad productivity classes:

(a) Productive Forest Lands which support either coniferous or deciduous tree growth capable of reaching merchantable size.

(b) Potentially Productive Forest Lands which include recent burns, old burns and clear-cut areas capable of producing merchantable timber. In many cases these areas are supporting regeneration but because of its size or the date and type of photography, the composition could not be determined.

(c) Non-Productive Forest Lands which are incapable of or not likely to produce commercial timber as it is presently defined by economic conditions. These lands include water, muskeg, cultivated lands, hay and grass meadows, permanent brush areas and barren lands above the tree line. In addition these lands include those marginal areas above tree line exhibiting only stunted growth and barren rock outcrops of the Precambrian region in the northeast corner of the province.

The forest inventory covers over 96 million acres. Forty-two per cent of this area is presently producing forest growth, twenty-seven per cent is potentially productive and thirty-one per cent is non-productive.

Almost all of the 25,817,282 acres of potentially productive land is in the form of old or recently burned areas. One per cent consists of clear-cut or windfall areas. Of the 29,828,007 acres of non-productive land the largest portion is muskeg or treed muskeg areas which total 71 per cent. Twelve per cent is water, four percent is permanent brushland and the remaining thirteen per cent is divided among cultivated lands, hay and grass meadows, barren areas and locations where trees are stunted due to elevation.

Combining the 40,645,381 acres of presently productive land with the potentially productive land provides a possible potential area of commercial forest cover of over 66 million acres. In some cases certain lands are reserved for uses other than timber production. It is expected that the drain on forest land for other uses will increase

Fig. No. 7

AREA DISTRIBUTION BY LAND CLASSES

TOTAL AREA: 96,000,000 ACRES

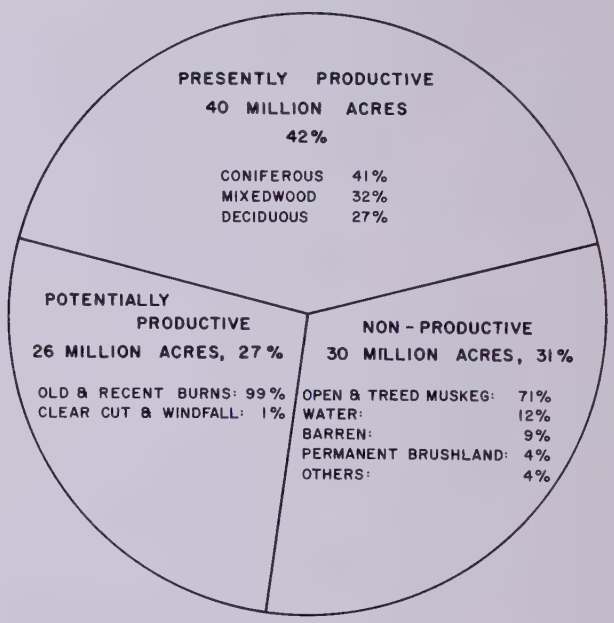


Table No. 2

AREA BY COVER TYPES

Thousands of Acres

Forest	Coniferous	Mixwood	Deciduous	Total
Athabasca	2,386	2,040	1,038	5,464
Bow River	1,099	100	107	1,306
Clearwater-Rocky	2,078	253	311	2,642
Crowsnest	482	22	68	572
Edson	3,099	621	301	4,021
Footner Lake	1,339	2,576	2,832	6,747
Grande Prairie	1,419	931	1,328	3,678
Lac La Biche	1,342	1,148	584	3,074
Peace River	821	1,579	1,735	4,135
Slave Lake	1,115	2,567	1,708	5,390
Whitecourt	1,341	1,077	723	3,141
Metis Colonies	22	124	329	475
Totals	16,543	13,038	11,064	40,645
Per Cent	41%	32%	27%	100%

in the future for such things as residential, industrial and manufacturing sites; roads, railroads and airstrips; parks, recreational areas and game preserves; reservations for soil stabilization and the regulation and conservation of water resources; areas for the extraction and production of minerals and petroleum; areas retained for aesthetic purposes along transportation routes, lake shores and rivers.

It is also very probable that in time a substantial part of the forest area may develop into agricultural usage.

VOLUME OF WOOD

The data gathered by summer field crews, (see page 7), included a tally of all trees four inches and over in diameter at breast height. The data permitted the calculation of the average cubic feet of wood per acre for each type of timber. No volumes were calculated for stands of timber that averaged less than thirty feet in height because almost all trees of that height are less than four inches in diameter.

Stand volume tables, showing the average component volumes of each species in a type, were compiled for every type present within the various zones of the inventory. Subsequently these volumes, multiplied by the acreage of each type on a map sheet, produced the total volume per township. Summary volume statements for management units, for administrative divisions or for other required blocks are obtained by adding together the township figures for the area. If the selected area does not comply with an established boundary then the map is remeasured and volumes recalculated to provide the desired result.

In this report summary volume data and indeed all inventory figures are provided in terms of administrative divisions.

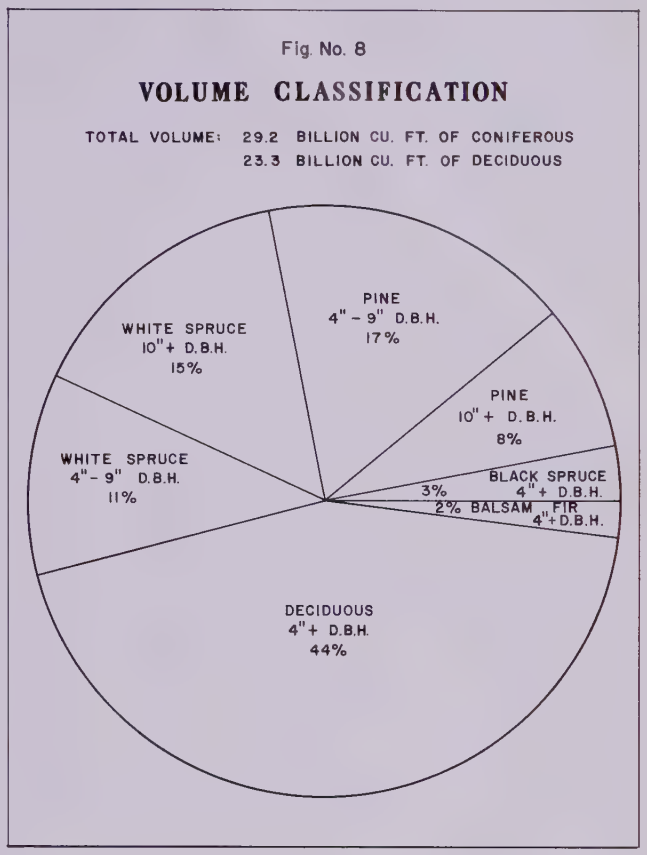
The total volume of timber at the end of 1967 was 52.5 billion cubic feet. This figure allows for loss by larger fires during the period between inventory date and the end of 1965 but does not allow for growth or timber depletion by cutting, during that period.

Although the deciduous species comprise almost half of the total volume, their annual utilization has never exceeded five per cent of the total annual production of the Province.

The gross volumes in cunits (one hundred cubic feet) of all trees 4 inches diameter at breast height and over are as follows :

Fig. No. 8

VOLUME CLASSIFICATION



	Volume in Cunits	Per Cent
White spruce 4 inches to 9 inches DBH	55 million	11%
White spruce 10 inches DBH and over	79 million	15%
Black spruce 4 inches DBH and over	16 million	3%
Balsam fir 4 inches DBH and over	11 million	2%
Lodgepole and jack pine 4 inches to 9 inches DBH	91 million	17%
Lodgepole and jack pine 10 inches DBH and over	40 million	8%
Deciduous species 4 inches DBH and over	233 million	44%
Total	525 million	100%

Volumes of white spruce and pine have been arbitrarily separated at diameters which are considered to be the division between sawlog trees and pulpwood trees. However, timber management policies have since changed and many berths, particularly where pine is the major species, are presently sold for sawlogs at lower cutting diameters.

Table No. 3 indicates volumes by Forests and shows sawlog volumes of white spruce and pine in board feet and other volumes in cords. Table No. 4 lists average volume per acre in cubic feet by component species. The latter table brings out several important factors of volume distributions.

The average volume of timber per acre in the northern Forests of Footner Lake and Athabasca is significantly lower than in other Forests. This is not a reflection of poorer site productivity but of frequent fires and lower average age of trees. The average volume per acre of white spruce is quite consistent throughout the province showing that it is well distributed. Pine, however, has much higher values per acre in the foothills of the Clearwater-Rocky, Edson and Bow River Forests and the Swan Hills area of the Whitecourt Forest. Average coniferous and deciduous volumes per acre by Forest are shown graphically in Figure No. 9. The highest average volumes per acre are found in the Whitecourt and Slave Lake Forests.

Table No. 3

TOTAL VOLUME BY SPECIES, PRESENTLY FORESTED AREA

M Cords and M F.B.M.

Forest	Area in Acres	Sw		Sb	Fb	P		Deciduous
		4″ - 9″ M Cords	10″ + M FBM	4″ + M Cords	4″ + M Cords	4″ - 9″ M Cords	10″ + M FBM	4″ + M Cords
Athabasca	5,464,012	4,433	2,707,604	2,319	608	7,237	1,434,768	22,630
Bow River	1,306,179	1,429	1,312,782	99	463	5,855	1,254,633	1,535
Clearwater-Rocky	2,642,153	3,236	2,463,392	982	605	13,446	2,588,552	7,195
Crowsnest	571,384	644	1,250,213	—	337	1,788	448,928	307
Edson	4,021,105	6,690	4,086,270	1,456	3,759	26,689	5,291,416	12,183
Footner Lake	6,746,774	9,571	5,846,359	2,974	613	4,772	946,019	43,371
Grande Prairie	3,678,397	6,626	4,047,708	819	1,721	12,868	2,551,113	29,140
Lac La Biche	3,073,506	4,613	2,818,124	2,413	632	7,532	1,493,361	23,554
Peace River	4,135,119	7,520	4,593,345	2,337	481	3,749	743,300	34,077
Slave Lake	5,390,641	12,762	7,795,526	3,147	2,237	8,507	1,686,676	65,870
Whitecourt	3,141,439	7,093	4,332,874	1,916	1,621	14,035	2,782,566	28,803
Metis Colonies	474,672	734	448,251	54	51	120	23,862	4,997
Totals	40,645,381	65,351	41,702,448	18,516	13,128	106,598	21,245,194	273,662

Table No. 4

AVERAGE VOLUME PER ACRE PRESENTLY FORESTED AREA

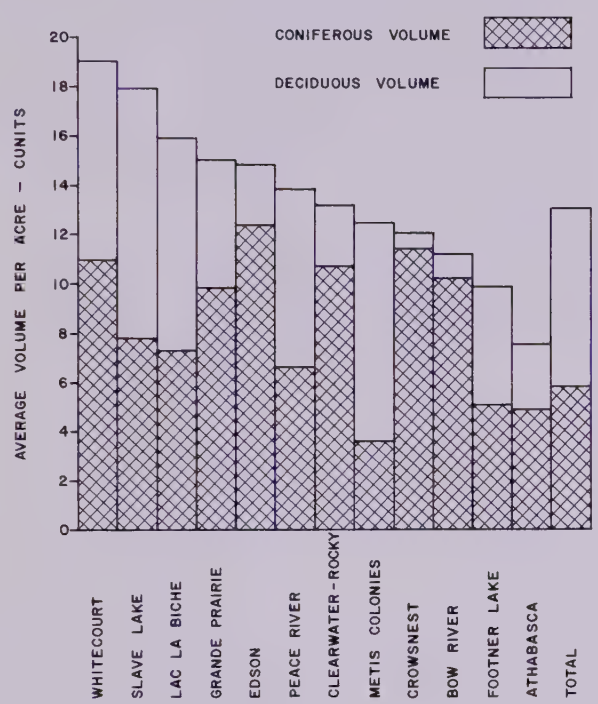
Cubic Feet (4″ DBH and Over)

Forest	Area in Acres	Sw	Sb	Fb	P	Total Coniferous	Deciduous	Total
Athabasca	5,464,012	157	37	9	238	441	289	730
Bow River	1,306,179	326	7	35	648	1,016	115	1,131
Clearwater-Rocky	2,642,153	318	36	22	700	1,076	262	1,338
Crowsnest	571,384	597	—	59	486	1,142	53	1,195
Edson	4,021,105	334	31	79	813	1,257	257	1,514
Footner Lake	6,746,774	350	41	8	56	455	530	985
Grande Prairie	3,678,397	361	19	40	428	848	673	1,521
Lac La Biche	3,073,506	357	133	22	200	712	884	1,596
Peace River	4,135,119	348	50	19	209	626	756	1,382
Slave Lake	5,390,641	475	50	35	193	753	1,039	1,792
Whitecourt	3,141,439	453	52	44	547	1,096	779	1,875
Metis Colonies	474,672	310	10	9	31	360	894	1,254
TOTALS	40,645,381	335	39	28	326	728	580	1,308

AGE CLASS DISTRIBUTION

Fig. No. 9

AVERAGE VOLUME PER ACRE BY FORESTS



Again, during inventory field work, ages were established in most plots to permit an analysis of age class distribution. The complexity of types and zones in a forested area as large as that of Alberta complicated this analysis considerably. The result was that ages were assigned by height classes. This method proved to be reasonably accurate. This distribution is shown by volume in Table No. 5 and by percentage of area in Figure No. 10. The volume is poorly distributed with the largest portion in the Immature age class and the second largest part in the Young age class.

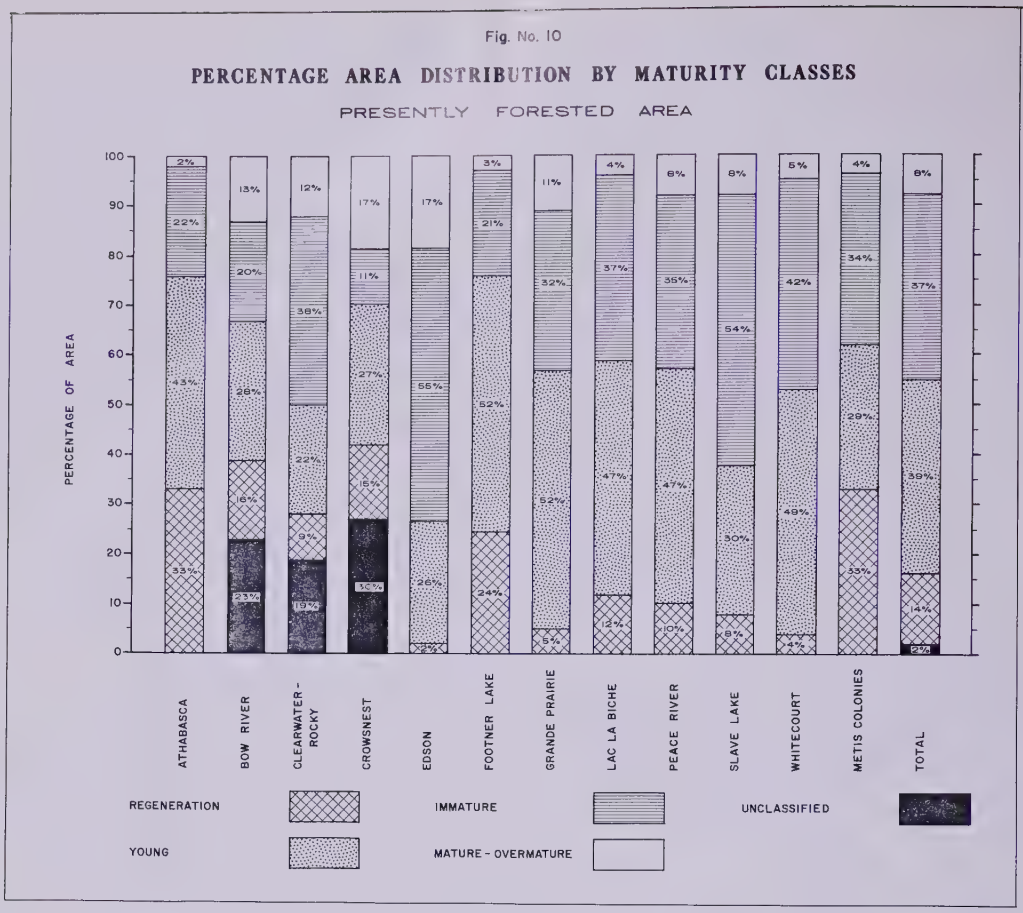
There is a wide variation by Forests in the area of each age class. Although overmature stands should not occur in well managed forests they are bound to be present in inaccessible areas, and in many areas must be at least partially retained for watershed protection.

Table No. 5

VOLUME DISTRIBUTION BY MATURITY CLASSES, PRESENTLY FORESTED AREA

Maturity Class	Area in Acres	Area %	Thousands of Cunits Sw 4″-9″	Sw 10″+	Sb	Fb	P 4″-9″	P 10″+	Deciduous	Total	Cunit Average Volume Per Acre
Regeneration	5,686,349	14	No Volume								
Young	15,827,362	39	9,366	12,192	2,889	1,110	29,806	11,839	81,055	148,257	9.4
Immature	14,950,756	37	32,580	44,626	10,310	6,018	47,735	21,037	130,296	292,602	19.6
Mature	2,741,523	7	10,843	16,207	2,464	3,228	11,824	6,029	18,606	69,201	25.2
Overmature	461,799	1	2,734	5,724	75	786	1,236	1,233	2,658	14,446	31.3
Unclassified	977,592	2	25	85	—	17	8	24	—	159	0.1
TOTALS	40,645,381	100	55,548	78,834	15,738	11,159	90,609	40,162	232,615	524,665	12.9

Fig. No. 10



ALLOWABLE ANNUAL CUT

Table No. 6

GROSS ALLOWABLE ANNUAL CUT

Forest	Coniferous Sawlogs M. F.B.M.	Coniferous Pulpwood M. Cords	Total Coniferous M. Cu. Ft.	Deciduous in M. Cords	Deciduous in M. Cu. Ft.	Total M. Cu. Ft.
Athabasca	81,113	365	46,358	647	54,995	101,353
Bow River	51,750	196	26,442	44	3,740	30,182
Clearwater-Rocky	102,312	457	58,186	206	17,510	75,696
Crowsnest	32,707	69	12,048	9	765	12,813
Edson	191,883	965	118,298	348	29,580	147,878
Footner Lake	127,320	448	62,148	1,239	105,315	167,463
Grande Prairie	130,286	551	71,464	832	70,720	142,184
Lac La Biche	84,425	380	48,259	673	57,205	105,464
Peace River	100,033	352	48,830	974	82,790	131,620
Slave Lake	179,219	666	90,489	1,882	159,970	250,459
Whitecourt	140,613	617	79,026	823	69,955	148,981
Metis Colonies	8,680	24	3,681	142	12,070	15,751
TOTALS	1,230,341	5,090	665,229	7,819	664,615	1,329,844

*Based on the following rotations using Von Mantel's Formula:

White Spruce Sawlogs—110 years
Pine Sawlogs — 90 "
Coniferous Pulpwood — 80 "
Deciduous Pulpwood — 70 "

Converting Factors:

1 Cubic Foot = 5.29 board feet
1 Cord = 450 board feet
1 Cord = 85 cubic feet

The gross allowable annual cut shown in Table No. 6 far exceeds the present depletion by cutting. However, the total allowable cut of over 1,329 million cubic feet should properly be decreased to allow for depletion by decay and annual fire loss, retention of trees for watershed protection and erosion control, timber that is physically inaccessible, and timber that is economically unmerchantable because of size and volume per acre. These factors presently reduce allowable cuts by a minimum of 25 per cent and probably by more than 50 per cent.

There is every indication that technological and silvicultural advances will increase the yield per acre by substantial proportions in the future. Some probable improvements follow:

1. Completely integrated operations. On a sawlog economy the recovery per acre is only about 45 per cent of the merchantable cubic foot volume. Under completely integrated use the recovery could increase to 90 per cent. Complete integration alone could double the allowable cut.
2. Over three-fourths of the forested area is understocked and producing less than its maximum volume per acre. Planting or seeding of understocked areas and thinning of overstocked stands could increase total production by over 100 per cent.
3. Utilization of thinnings that are normally lost by natural mortality could increase yield by more than 25 per cent.
4. The calculation of allowable cut did not include the 26 million acres of potentially productive land. This vast area, if it is made productive, can increase the allowable cut by more than 70 per cent.

Under present market conditions for forest products only the first improvement appears possible in the near future. However, if wood requirements increase in proportion to population increase, the other factors will assume importance as they have in several European countries.

FOREST PRODUCTION

Table No. 7

AVERAGE ANNUAL FOREST PRODUCTION ON CROWN LANDS BY SPECIES AND PRODUCT

Based on 10 Year Period April 1, 1958 to March 31, 1968

		Species								
Product		Pine	Spruce	Poplar	Balsam Birch	Douglas Fir	Fir	Tamarack	Total	Percent
Lumber	(M FBM)	108,211	213,488	3,149	883	98			325,829	
	M Cu. Ft.	20,456	40,357	595	167	18			61,593	59
Railway Ties	(Pieces)	586,770							586,770	
	M Cu. Ft.	3,882							3,882	4
Plywood	(M FBM)	11,510	16,766	12,868	81				41,225	
	M Cu. Ft.	2,176	3,169	2,433	15				7,793	8
Pulpwood	(Cords)	178,043	133,053						311,096	
	M Cu. Ft.	15,134	11,309						26,443	25
Round Timber	(Lin. Ft.)	19,833,697						3,550,000	23,383,697	
	M Cu. Ft.	3,134						561	3,695	3
Mine Ties	(Lin. Ft.)	52,830							52,830	
	M Cu. Ft.	20							20	
Fuelwood	(Cords)		3,149	3,058					6,207	
	M Cu. Ft.		268	260					528	1
Shingles	(Pieces)	21,514							21,514	
	M Cu. Ft.	—							—	—
Slabs	(Cords)	439	310						749	
	M Cu. Ft.	37	37						64	—
Lath	(Pieces)	2,074,881	145,568						2,220,449	
	M Cu. Ft.	71	4						75	—
TOTAL	M Cu. Ft.	44,910	55,134	3,288	182	18		561	104,093	100
PER CENT		43	53	3				1	100	

In the last decade the volume of forest production in Alberta has not varied in any significant degree from year to year. Pulpwood now constitutes a substantial proportion of the total forest production of the Province. Table No.'s 7 and 8 show the average annual production by products.

Prior to the establishment of the pulp mill at Hinton and the commencement of pulpwood cutting in 1956, the manufacture of timber accounted for 85% of the total volume of production in Alberta. Increased production of pulp and plywood products in recent years has reduced the lumber portion to below 60 per cent of total production.

Table No. 8

AVERAGE ANNUAL FOREST PRODUCTION ON CROWN LANDS BY FORESTS AND PRODUCTS

Based on Ten Year Period April 1, 1958 to March 31, 1968

Product	Athabasca	Bow River	Clearwater -Rocky	Crows-nest	Edson	Footner Lake	Grande Prairie	Lac La Biche	Peace River	Slave Lake	White-court	Metis Colonies	Total
Lumber (MFBM)	951	16,577	27,468	23,760	11,092	12,147	39,024	16,347	30,437	66,559	74,467	7,000	325,829
Railway Ties (Pieces)		1,921	54,635		319,415		6,010	4,275	16,203	56,255	128,056		586,770
Plywood (MFBM)	279	6	196	456	329		24,148	220	128	13,916	1,547		41,225
Pulpwood (Cords)	274	191	3.320		296,739		34	63	164	2,248	8,063		311,096
Round Timber (M Lin. Ft.)	7	5,912	4,030	1,633	2,425	116	1,178	1,710	606	2,001	3,766		23,384
Mine Ties (M Lin. Ft.)		53											53
Fuelwood (Cords)	866	95	195	86	141	2,092	286	428	863	846	309		6,207
Shingles (M Pieces)			11			1	6		3				21
Slabs (Cords)	17	28	14	293	246			20	9	16	106		749
Lath (M Pieces)		134	1,272	669				102		14	30		2,221
Christmas Trees		4,136	4,972	1,283	779		930	576	216	116	8,052		21,060
Trees for Transplanting		168	1,084	171	7			6		6	1,288		2,730

ALLOWABLE ANNUAL CUT VERSUS DEPLETION

Major annual depletion agents in Alberta are commercial timber operations, fire, insects and disease. Blowdown and other damage by weather undoubtedly cause losses each year but these have not been measured.

The depletion by cutting is shown for a ten year period in Table No. 9. The demand for deciduous timber is still very limited and accounts for only 3 per cent of production. It is, however, increasing in importance. The average reduction of total growing stock per year by cutting amounts to 0.20 per cent.

The loss by fire over a ten-year period is indicated in Table No. 10. The acreage loss amounts to 0.07 per cent per year, a great reduction from the figure of more than one per cent per year which was obtained prior to 1950. Similarly the average annual reduction in volume of growing stock through fires for the ten year period is 0.07 per cent per year.

The loss by fire has decreased substantially in the past decade, and has reached an acceptable level. This level is considered to be less than 0.10 per cent per year of the productive forest area. Loss by fire is now less than depletion by cutting.

The total annual loss of wood through decay is difficult to determine accurately. However, cubic foot estimates of decay at 100 years of age approximate 3 per cent for white spruce on good and medium sites, about the same amount for lodgepole pine, 33 per cent for aspen and 13 per cent for balsam poplar. The weighted average is approximately 15 per cent at 100 years or 0.15 per cent per year.

Summarizing the total annual depletion of growing stock, it appears that 0.20 per cent is utilized in forest production, 0.07 per cent is lost through fire and 0.15 per cent by decay totalling 0.42 per cent per year. Thus the annual depletion of approximately 220 million cubic feet is 17 per cent of the gross allowable annual cut. More realistic rotation ages based on maximum yield permit even greater allowance for cutting.

Table No. 9
AVERAGE ANNUAL FOREST PRODUCTION ON CROWN LANDS
BY FORESTS AND SPECIES

Based on Ten Year Period
April 1, 1958 — March 31, 1968

Forest	Volume in Thousands of Cubic Feet				
	Pine	Spruce	Other Coniferous	Deciduous	Total
Athabasca	1	290	—	41	332
Bow River	3,238	858	32	5	4,133
Clearwater —Rocky	3,789	2,579	51	152	6,571
Crowsnest	1,763	2,994	134	—	4,891
Edson	18,864	10,966	11	70	29,911
Footner Lake	13	2,385	5	89	2,492
Grande Prairie	2,799	9,126	60	210	12,195
Lac La Biche	1,274	1,934	151	118	3,477
Peace River	2,303	3,663	22	81	6,069
Slave Lake	2,934	11,119	136	1,977	16,166
Whitecourt	7,933	7,895	160	545	16,533
Metis Colonies	—	1,323	—	—	1,323
TOTALS	44,911	55,132	762	3,288	104,093

Table No. 10
VOLUME OF TIMBER LOST THROUGH FIRES

1958 - 1967

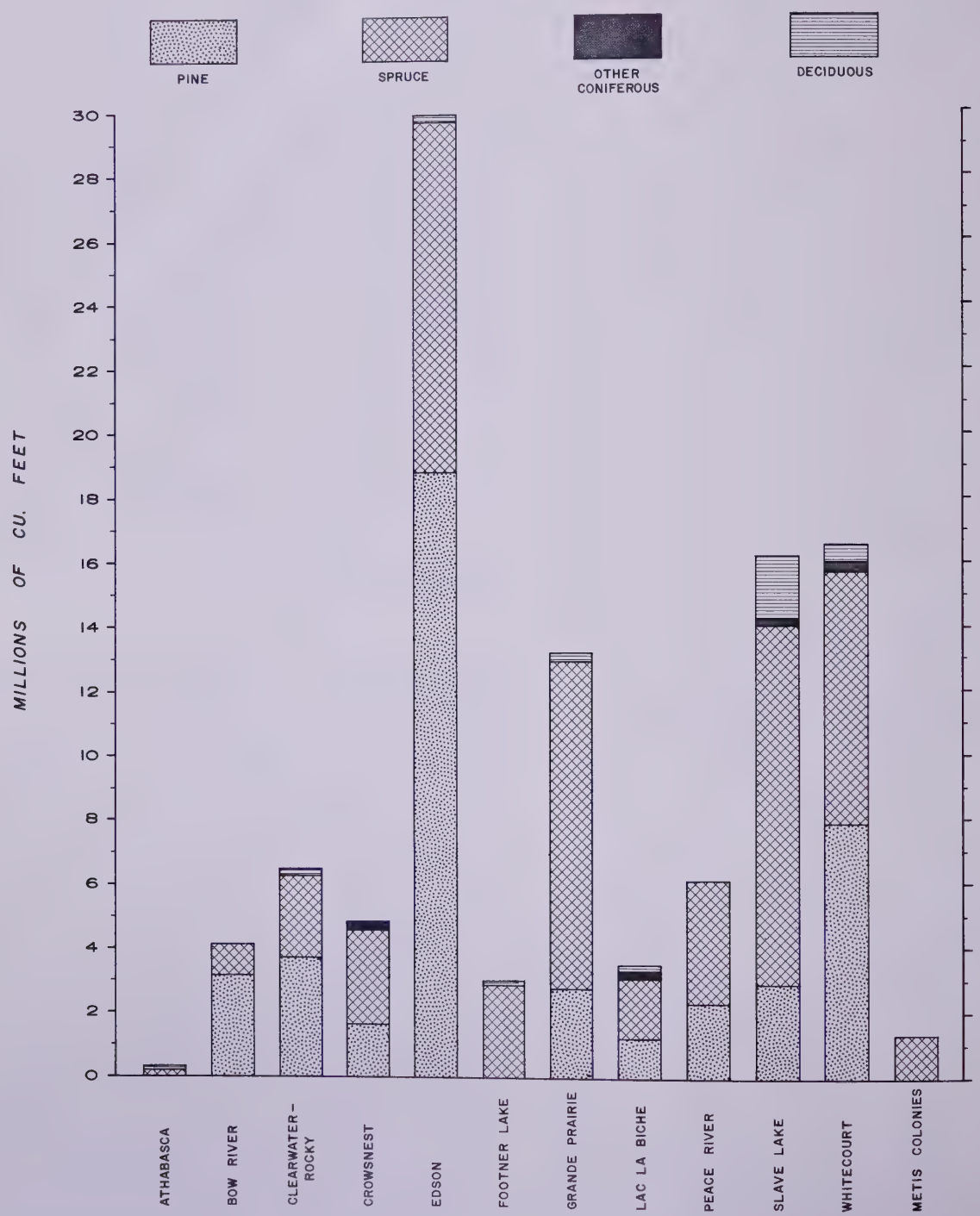
Year	Acres Burnt	Sawtimber M Cu. Ft.	Other M Cu. Ft.	Total M Cu. Ft.
1958	230,993	20,788	107,899	128,687
1959	87,959	3,872	21,654	25,526
1960	19,960	199	1,268	1,467
1961	193,545	29,637	106,429	136,066
1962	4,506	861	2,978	3,839
1963	17,609	2,224	8,633	10,857
1964	15,057	1,189	3,571	4,760
1965	54,334	3,584	24,069	27,653
1966	69,950	4,287	17,169	21,456
1967	23,216	1,311	8,609	9,920
TOTALS	717,129	67,952	302,279	370,231
Average Per Year	71,713	6,795	30,228	37,023

SKETCHMASTER

CRUISER SUPPLY TEAM

Fig. No. 11

FOREST PRODUCTION ON CROWN LANDS BY FORESTS



FOREST MANAGEMENT PLANNING

Since the completion of the forest inventory for northern Alberta in 1956, a more detailed inventory has been carried out on selected area within this region. This program includes finer details in photo interpretation of forest cover and more intensive field work to provide more accurate volume information, age class distribution and site classification. New aerial photography is taken of each area prior to the commencement of field work. The maps that are produced provide more detail and the statistical data is analyzed more carefully. More accurate allowable annual cuts can also be calculated, using the more detailed inventory data.

The objective of forest management planning in Alberta is sustained yield management. This involves the adoption of policy and methods of handling forest resources to achieve continuous production of wood products at a maximum level as soon as it is practicable to do so. As long as total depletion is equal to or less than the growth, then part of the objective of sustained yield is being met. Because of the poor arrangement of unmanaged forests it generally requires at least one rotation of planning and development to bring about a desirable distribution of growing stock. Better utilization and silvicultural practices will result in larger allowable cuts and fluctuations in demand and market conditions will effect the allowable cut to some extent. Consequently it is necessary to make periodic adjustments in management plans to allow for these changes. However, a continuous equal periodic supply of raw material from each area under management stabilizes the economy of communities dependent upon the forests. This in turn simplifies the responsibility of governments to supply adequate and regulated social services. Since adopting the principle of sustained yield, Alberta has begun to develop plans and policies to meet the objectives of sustained yield forest management.

Map 4 shows the progress in forest management planning. This map indicates forest management units for which long range allowable annual cuts are available, units having timber quotas and units for which multiple use management plans have been written. These plans are being prepared for the units of the Crowsnest, Bow River, and Clearwater-Rocky Forests and the plans coordinate water production, timber harvesting, recreational use, oil and gas exploration and production and the use of the fish and wildlife resource.

Refinements and adjustments will be constantly required in order to develop maximum yields and utilization.

SUMMARY

Alberta has a forest area, including the Rocky Mountains Forest Reserve, of 150,000 square miles which contains in excess of 50 billion cubic feet of wood material 4 inches in diameter breast height and over.

Because of excessive forest fire damage in the past, the age class distribution is poor so that present volume figures are misleading and do not represent the potential capabilities of yield. It is inevitable that some of the forest area will develop into agricultural use. However, the technical advancements in forest utilization and management should more than exceed the agricultural demands for forest land.

The forest inventory of Alberta provides a working knowledge of the present resources. However, the most valuable product of the inventory was the revelation that, with planned management, better utilization, improved silvicultural practices and especially more adequate protection from fires, the forest industry of Alberta is able to make a very notable and permanent contribution to the economic stability and wealth of the Province.

If the 66 million acres of productive and potentially productive land are fully developed they can produce a volume of wood products many times greater than the volume presently provided. The chief deterrent to this prosperity is forest fire.

The forests do not only represent a tangible income from wood production and domestic grazing but include many times that value in the form of watershed protection and regulation, a habitat for wildlife, and a recreational playground. As population increases so will the value of these assets increase. Wise multiple use management of the forest areas will protect these values for future generations.

GLOSSARY

Aeolian—Borne and deposited by wind.

Age Class Distribution—The local occurrence of age classes of trees or the representation of different age classes in a forest. Ideal distribution is a complete series of age classes that will permit equal annual or periodic cutting during a rotation, (see definition **rotation** — page 37).

Allowable Annual Cut—The volume of wood that may be removed from a properly managed area each year.

Alluvial—Soil material transported by flowing water.

Coniferous—Belong to the order Coniferae, usually evergreen with cones and needle-shaped leaves and producing wood known commercially as "softwood". In Alberta tamarack and alpine larch shed their needles in the winter but are still coniferous.

Cord—A unit of measurement of stacked wood. A standard cord, the kind referred to in this report, contains 128 cubic feet within its outside surfaces. The standard dimensions are 4-foot long sticks piled four feet high in a stack 8 feet long.

Cunit—A unit of volume measure containing 100 cubic feet. Used in Alberta as 100 solid cubic feet of wood.

Deciduous—Trees that shed their leaves each winter. The term is used in Alberta to designate the class of broad-leaved trees known commercially as "hardwoods" and consequently represents the class of trees opposite to coniferous.

Diameter Breast High—(D.B.H.) The diameter of a tree at 4:5 feet above average ground level. Usually abbreviated to d.b.h.

Foot, Board—A unit of measurement represented by a board 1 foot long, 1 foot wide and 1 inch thick. Abbreviated to f.b.m. (foot board measure), and bd. ft. In finished or surfaced lumber, the board foot measure is based on the measurement before surfacing or other finishing. In practice the working unit is 1,000 board feet, abbreviated herein to M f.b.m.

Foot, Cubic—A cube 12 inches on each side. A cubic foot of wood is considered to contain from about 4 to 10 board feet depending on natural and manufacturing losses. In Alberta a conversion factor of 1 cubic foot equals 5.29 board feet has been used for inventory conversions.

Lacustrine—Soil material laid down in still water such as lakes.

Map, Forest Cover—A planimetric map that also indicates the type of timber present in the area covered by the map. The timber types are usually designated by symbols, representing the height, density, species, etc. Planimetric detail is not necessary but the map must have some indication of survey location.

Map, Planimetric—A map which presents only the horizontal positions of represented features; distinguished from a topographical map by the omission of relief in measureable form. Natural features usually shown on a planimetric map include rivers, creeks, lakes, seas and mountains. Cultural features include cities, towns, villages, post offices, transportation routes, public utility facilities, private and political boundaries, survey lines,etc. Planimetric maps intended for special use may present only those features essential for its purpose. The scale of the map generally determines the amount of detail on it.

Non-Productive Forest Land—Land which is incapable of or not likely to produce timber of commercial value. In the Alberta inventory this includes land under water in lakes, rivers, sloughs, etc., muskegs (both open and wooded), cultivated lands, hay and grass meadows, permanent brush areas, barren lands above tree line, areas where trees are stunted due to elevation and rock barrens.

Podsolized—A term used to identify soil in which the action of water has removed basic chemicals and created an acid condition. With reference to grey wooded soils, the iron and alumina are removed from the upper horizon more rapidly than silica, leaving light colored or grey wooded upper horizons.

Potentially Productive Forest Land—Land capable of producing commercial forest crops. In the Alberta inventory it includes lands that are presently productive but containing species less than 30 feet in height which could not be positively identified on the photographs at the time of interpretation. It also includes lands that were and could again be commercially productive if seeded, planted or otherwise treated to improve seed germination and survival conditions.

Presently Productive Forest Land—Land which is presently producing timber crops that are merchantable or will develop into merchantable stands. It includes all forest types on productive soils that are five feet or taller and may be identified on aerial photographs as to species at the time of photo-interpretation.

Rotation—The period of years required to establish and grow timber crops to a specified condition of maturity. Several types of rotation are recognized depending on the economic, silvicultural or technical factors involved.

Silviculture—The art of producing and looking after a forest; the application of the knowledge of growth habits and characteristics to the treatment of a forest.

Site—An abstract term indicating the combination of all factors that contribute to the growing capacity of an area to produce forests or other vegetation, including the biotic (living), climate and soil conditions of the area.

Soil Horizons—The more or less distinct layers of soil that are developed as a result of the various soil forming factors. A soil profile or cross-section is divided into A. B and C Horizons. The A horizons are the portions of the profile from which materials are leached by percolating rain water and in which the organic matter usually accumulates. The B horizons are the portions in which the materials leached from the A horizon accumulate. Together the A and B horizons form the solum which represents the true soil formed by the soil building agencies. The C horizon is the relatively unaltered parent material, such as clay hard-pan, which lies in contact with the soil above. The A and B horizons are further sub-divided depending on differences in the degree of removal and the type of accumulation.

Stand (Timber)—An aggregation of trees, occupying a specific area and sufficiently uniform in composition, (species), age arrangements and condition as to be distinguishable from the forest or other growth on adjoining areas.

Stand Volume Table—For application in Alberta it is a summary table showing the average volume per acre by component species for any tree stand or type. It was developed by averaging the component species volume per acre for all plots within a specific forest type.

Stereoscope—A binocular optical instrument for assisting the observer to view two properly oriented photographs or diagrams to obtain the visual impression of a three-dimensional model.

Sustained Yield—As applied to forest management — the policy, methods and plans which achieve continuous production at a maximum level at the earliest practicable time. The objective is an approximate balance between net growth and total depletion either on an annual or longer periodic basis. Sustained yield forest management implies the use of advanced silvicultural and utilization practices to derive the maximum yield from each acre of forest land compatible with sound forest practices.

Timber, Merchantable—A tree or stand of trees which may be disposed of at a profit through conversion to saleable products. The determination of merchantability is affected by location, desired product, demand, investment requirements, condition of the timber, etc.

Vision, Stereoscopic—That application of binocular vision which enables the observer to view an object simultaneously from two different perspectives (as two photographs taken from different camera stations) to obtain the visual impression of a three-dimensional model.

APPENDIX

Coniferous Species—

White spruce ..... *Picea glauca (Moench) Voss*
Western White spruce ... *Picea glauca (Moench) Voss var. Albertiana (S. Brown) Sarg.*
Black spruce ..... *Picea mariana (Mill.) B.S.P.*
Engelmann spruce ..... *Picea Engelmanni Parry*
Lodgepole pine ..... *Pinus contorta var. latifolia Dougl.*
Jack pine ..... *Pinus Banksiana Lamb.*
Limber pine ..... *Pinus flexilis James.*
Whitebark pine ..... *Pinus albicaulis Engelm.*
Balsam fir ..... *Abies balsamea (L.) Mill.*
Alpine fir ..... *Abies lasiocarpa (Hook.) Nutt.*
Douglas fir ..... *Pseudotsuga taxifolia (Poir) Britton var. glauca (Mayr) Sudw.*
Tamarack ..... *Larix laricina (Du Roi) K. Koch.*
Alpine larch ..... *Larix lyallii Parl.*

Decidious Trees—

Aspen ..... *Populus tremuloides Michx.*
Black poplar ..... *Populus balsamifera L.*
White birch ..... *Betula papyrifera Marsh.*

NOTES

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